CLINICAL SIGNIFICANCE OF SERUM AND URINARY AMYLASE IN ACUTE PANCREATITIS

BY

DR.SUGUMARAN.K

Dissertation submitted to

THE TAMILNADU DR.M.G.R. MEDICAL UNIVERSITY

In partial fulfillment of requirements for the degree of

M.S. GENERAL SURGERY – BRANCH I

DEPARTMENT OF GENERAL SURGERY

THANJAVUR MEDICAL COLLEGE AND HOSPITAL

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Prof. Dr.W.EDWINA VASANTHA M.S.,

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MAY, 2018

DECLARATION BY THE CANDIDATE

I solemnly declare that this Dissertation **"CLINICAL SIGNIFICANCE OF SERUM AND URINARY AMYLASE IN ACUTE PANCREATITIS"** was done by me in the Department of General Surgery, Thanjavur Medical College, and Hospital, Thanjavur under the Guidance and Supervision of my Professor Dr.W.EDWINA VASANTHA M.S. Department of General Surgery, Thanjavur Medical College, Thanjavur between 2016 and 2017.

This Dissertation is submitted to THE TAMILNADU DR. M.G.R MEDICAL UNIVERSITY, Chennai in partial fulfillment of University requirements for the award of M.S Degree (GENERAL SURGERY).

DR.SUGUMARAN.K

Postgraduate Student,

Dept. of General Surgery,

Thanjavur Medical College,

Thanjavur.

CERTIFICATE BY THE GUIDE

This is to certify that this dissertation titled **"CLINICAL SIGNIFICANCE OF SERUM AND URINARY AMYLASE IN ACUTE PANCREATITIS"**is a bonafide research work done by **Dr.SUGUMARAN.K,** in partial fulfillment of requirement for the degree of **M.S.GENERAL SURGERY – BRANCH I.**

Dr.W.EDWINA VASANTHA M.S.,

Associate Professor,

Department of General Surgery,

Thanjavur Medical College and Hospital.

(Guide)

Date:

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This is to certify that the dissertation titled **"CLINICAL SIGNIFICANCE OF SERUM AND URINARY AMYLASE IN ACUTE PANCREATITIS"** is a bonafide research work done by **DR.SUGUMARAN.K** under the guidance of **Dr.W.EDWINA VASANTHA M.S.,** (Associate Professor, Department of General Surgery) Thanjavur Medical College Hospital, Thanjavur.

Dr.S.JEYAKUMAR MCh,

The Dean,

Thanjavur Medical College,

Thanjavur – 613004.

DR.M.ELANGOVAN M.S,

Professor and HOD,

Department of General surgery,

Thanjavur Medical College,

Thanjavur – 613004.

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submitted by Dr. SUGUMARAN. K **of**

Dept. of GENERAL SURGERY **Thanjavur Medical College, Thanjavur**

was approved by the Ethical Committee.

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LIST OF ABBREVIATIONS USED

AP	Acute pancreatitis
SIRS	Systemic inflammatory response syndrome
BISAP	Bedside index of severity in acute pancreatitis
CTSI	Computed tomography severity index
CT	Computed tomography
CNP-G3	2-chloro-4-nitrophenyl maltorioside
PBM	Pancreaticobiliary Maljunction
SOD	Sphincter of Oddi dysfunction
RAC	Revised Atlanta classification
ANP	Acute necrotizing pancreatitis
CP	Chronic Pancreatitis
OF	Organ failure
ERCP	Endoscopic retrograde cholangiopancreatography
SAP	Severe Acute pancreatitis
ROC	Receiver Operating Characteristic

ABSTRACT

INTRODUCTION:

Acute pancreatitis is one among the commonest acute abdominal conditions presenting to casualty. Most commonly it is Ethanol related acute pancreatitis. CT abdomen has been used widely to diagnose and also to exclude other acute abdominal condtions.Serum amylase is still being widely used to assist the diagnosis of acute pancreatitis. Most of the cases with typical symptoms can be diagnosed clinically but still few cases with atypical/mild symptoms with normal or subclinical serum amylase become difficult to diagnose. So this may result in misdiagnosis of cases of acute pancreatitis.Many newer investigations like serum procalcitonin, IL,IL -6 and urinary trypsinogen-2 are now used in the diagnosis of acute pancreatitis. But most of these investigations are expensive and require trained personnel. Reports from Saxon et al[1], Budd et al[2], and Gambill et al[3]has shown that the hourly excretion rate of urinary amylase could be more frequently abnormal in the presence of pancreatic diseases than the serum concentration of either amylase or lipase.Thus this study is done to find the significance of urinary amylase levels and its comparison with serum amylase and serum lipase in cases of acute pancreatitis.

Materials and Methods:

All patients admitted in Thanjavur medical college Hospital, during 2016 December to 2017September with clinically suspected acute pancreatitis in the age group 25-45 and

with CT findings suggestive of acute pancreatitis were included in the study. Those with comorbidities like diabetes mellitus, hypertension and chronic kidney disease and those not willing for the investigations were not included in the study. In these cases serum amylase, urinary amylase (both done by Kit method with reagent used CNP-G3), and serum lipase (enzyme calorimetric method) was done within 24 hours of admission.Other investigations like complete hemogram, renal function test, were done and BISAP score was used in assessing the severity of pancreatitis. Reports were collected within one day and the values were compared. Their clinical significance and sensitivity in the diagnosis of acute pancreatitis, and its correlation to severity was analysed.Datas were entered and analysed statistically.

Results:

A total of fifty in patientswith acute pancreatitis were studied. All in the age group 25-45 years. Out of the fifty cases 48 were male and 2 female. Among the 50 cases 44 were due to alcohol related pancreatitis and 6 due to gallstones. Duration of symptoms was less than 4 days in 32 patients (64%) and more than4 days in 18 members (36%).SIRS was evident in 38patients (76%) and was not present in the rest 12 patients (24%). BISAP Score was 0-2 in 47 patients(94%) and 3-5 in 3 patients(6%). Based on CTSI 38 cases(76%) had mild acute pancreatitis(0-3) and 12(24%) had moderate acute pancreatitis(4-6), none had severe acute pancreatitis(7-10).Urinary amylase was elevated in all 50 cases(100%).Serum amylase was elevated >100 in 39 cases(78%),but significant (three times the upper limit >300) in 18 cases(36%), and 11 cases had normal values (22%). Serum lipase was elevated (>60) in 49 cases(98%) and normal in only 1 case (2%).Also urinary amylase was grossly elevated (>1001) in

patients with BISAP Score >2 and CTSI >3.The sensitivity of serum amylase for value >100 was found to be 70%, and the sensitivity of urinary amylase value >500 was found to be around 83%.

Interpretation and conclusion:

In this study it was found that urine amylase was more consistently elevated in all patients with acute pancreatitis, and also in cases where serum amylase was in the normal range. Most of the cases with normal or low serum amylase values were those who had duration of symptoms less than 3 days. Thus urinary amylase measurement can be used as more sensitive tool in diagnosis of acute pancreatitis when compared to serum amylase, especially in those with late clinical presentation of acute pancreatitis. Urinary amylase was also correlating with severity of pancreatitis being grossly elevated in patients with moderate acute pancreatitis than mild acute pancreatitis.

Keywords:

Acute pancreatitis, Urinary amylase, CTSI, BISAP score, Serum amylase, Serum lipase.

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INTRODUCTION

CHAPTER 1 : INTRODUCTION

Acute pancreatitis (AP) remains one of the most important cause of acute abdominal pain presenting in casualties, especially in our country where alcohol abuse is more common. Gallstone disease is identified as the most common aetiology of the first attack, accounting for 30–50%.Alcohol association is between 20 and 40% of patients with AP[4].Worldwide, the main aetiology is biliary tract disease (41%) and alcohol abuse (31.7%).

The clinical course may range from mild discomfort with minimal pancreatic inflammation(80%) to severe necrotizing pancreatitis, complicated by multiorgan system failure and death(20%).Thuscareful clinicalassessment and the judicial use of biochemical tests and radiological imaging enables us to differentiate AP from other causesof acute abdomen and to assess the severity of disease.

Serum amylase is being utilized more frequently than any other test in assisting the diagnosis of acute pancreatitis. The diagnosis of pancreatitis is usually not a problem in the patients with typical symptoms of acute pancreatitis or elevated serum amylase values. Diagnostic problems are encountered in the acute cases with atypical presentation or that have partially subsided or in the atypical cases with normal or subclinical serum amylase values.

In such cases, pancreatitis may be overlooked, diagnostic studies may be omitted, and hospitalization may not be indicated leading to misdiagnosis and increased morbidity and mortality from AP.Thus many newer investigations like serum procalcitonin,IL -6

and urinary trypsinogen-2 are now used in the diagnosis of acute pancreatitis. But most of these investigations are expensive and require trained personnel.

Reports from Saxon et al[1], Budd et al[2], and Gambill et al[3] has shown that the hourly excretion rate of urinary amylase could be more frequently abnormal in the presence of pancreatic diseases than the serum concentration of either amylase or lipase. Serum amylase usually remains elevated for 3–5 days in uncomplicated AP.Lower activities do not rule out the diagnosis as serum amylase activity may reduce or normalise within the first 24-48 hours. Measurement of urinary amylase activity, which remains high for longer periods, may be helpful in this situation[5].

Urinary amylase is increased in acute pancreatitis and may remain elevated for 7 to 10 days after serum levels have returned to normal[6].Thus it is useful in diagnosis of atypical cases with normal serum amylase and those cases with late presentation of AP.

Urinary amylase may also be useful in cases of hypertriglyceridemia and macroamylasemia in which serum amylase values may be misguiding diagnosis of AP.Thus this study is done to find the significance of urinary amylase levels and its comparison with serum amylase and serum lipase in cases of acute pancreatitis.

AIMS & OBJECTIVES

CHAPTER 2 : AIMS & OBJECTIVES

AIMS:

To compare the values of serum amylase, serum lipase and urinary amylase, and determining their significance in diagnosing acute pancreatitis immediately and after few days.

OBJECTIVES:

1. To determine and compare the values of serum amylase, serum lipase and urinary amylase in patients with acute pancreatitis.

2. To find the significance of urinary amylase and its sensitivity in diagnosing patients with acute pancreatitis.

3.To assess the correlation of severity of acute pancreatitis using BISAP score and CTSI with urinary excretion of amylase.

REVIEW OF LITERATURE

CHAPTER 3: REVIEW OF LITERATURE

3.1. ANATOMY OF PANCREAS

3.2. PHYSIOLOGY OF PANCREAS

3.3. INTRODUCTION TO AP

3.4. AETIOLOGY AND CLASSIFICATION

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3.9. INVESTIGATIONS OF AP

3.10. MANAGEMENT OF AP

3.11. COMPLICATIONS OF AP

3.12. URINARY AMYLASE

3.1. ANATOMY OF PANCREAS

EMROYOLOGY:

The precursors of the pancreas appear early in developmentas protrusions from the primitive gut at astage when it is simple and quite small (Fig.1). Althoughthe ventral and dorsal primordia are on oppositesides of the primitive gut, they are in fact very close to each other. In the ventral region, the ventralpancreatic primordium develops along with the primordiaof the liver, gallbladder, and associated ducts (Fig.2). While the dorsal and ventral pancreaticprimordia are expanding, the part of the primitivegut that gives rise to them is also growing and changing.[1]

The part of the primitive gut which forms theduodenum grows more on one side than another, androtates to the right. The ventral pancreas comes to lie adjacent and immediatelyposterior to the dorsal pancreas, and the ducts from the hepatic system and theventral pancreas join the duodenum close to wherethe duct of the dorsal pancreas joins the duodenum. The dorsal pancreas and ventral pancreas fuse. Their ducts anastomose (Fig.2).

The Wirsung'sduct is formed from the ventral pancreatic duct plusthe distal part of the dorsal pancreatic duct. The accessory pancreatic duct is formed from the remainderof the dorsal pancreatic duct, emptyinginto the duodenum at the minor papilla. The bile ductempties into the duodenum along with the main pancreaticduct at the major papilla.[2]

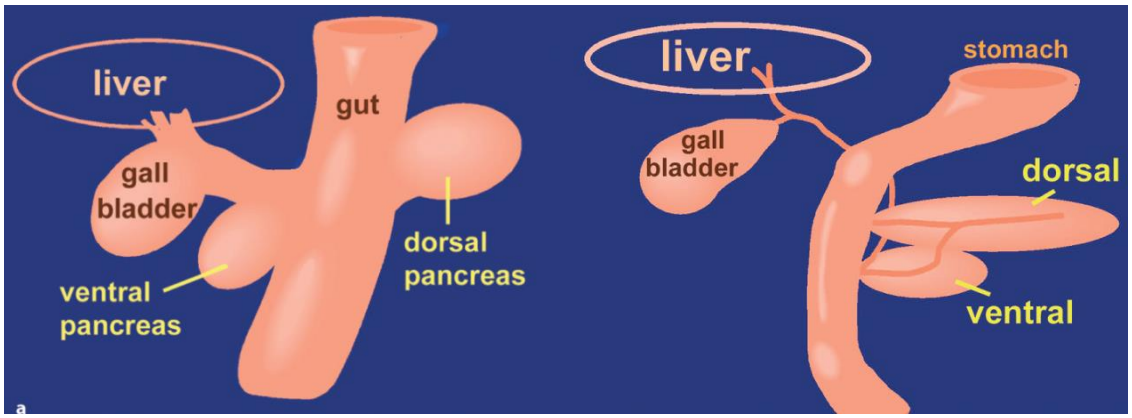

Fig.1.

Fig.2.

CONGENITAL ANOMALIES THE EXTRAHEPATIC BILE DUCTS AND PANCREAS:

1. Pancreaticobiliary Maljunction.

PBM is a congenital anomaly in which the junction ofthe pancreatic duct and biliary duct is located outsidethe duodenal wall (Fig.3); in the normal Pancreaticobiliary junction, the main pancreatic duct (MPD, Wirsung's duct) joins with the common bile duct(CBD) inside the muscle layer of the duodenum toform the ampulla of Vater (Fig.4).In the case of PBM, the union of theducts is situated external to the muscle layer of theduodenum, forming an extension to the muscularispropria of the duodenum, thus forms an extendedcommon channel [3].

The ductaljunction angle is less sharp in these patients than in controlcases. The well-developed sphincter muscle is situatedin the sub mucosal layer, as in controls, but it mainlysurrounds the common channel (sphincter ampullae);the sphincter choledochus is extremely hypoplastic.The anatomical findings suggest a probabilityof communication between the ducts in casesof PBM.

As the intraductal pressure of the pancreaticduct is normally higher than that of the bile duct [4],reflux of pancreatic juice may occur into the bile ductand can cause nonsuppurative chronic inflammationof the bile duct.

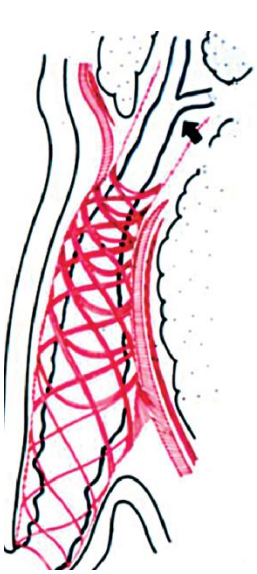

Fig.3

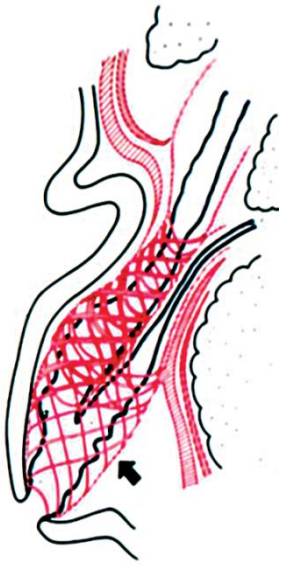

Fig.4

2. Pancreas Divisum

The parenchyma of the ventralpancreas and the dorsal pancreas are separated asa double pancreas in pancreas divisum. Recently, however, the term pancreas divisum has been used widely to describe two ductal systems, the ventral pancreatic duct and thedorsal pancreatic duct, which do not unite or communicateand separately drain to the two duodenalpapillae [5].

In this condition, pancreatic juice fromthe dominant dorsal moiety flows out only throughthe minor papilla, in which the outlet is notably smallin most cases.This leads to relative outlet obstruction, high intraductal pressure and triggers pancreatitis.This raises the question of whether thisvariation plays a role in the development of pancreaticpain or pancreatitis.

The clinical relevance of pancreasdivisum has been argued repeatedly [5].This conditionstrongly suggests inadequate drainage from the minorpapilla. (Fig 5).

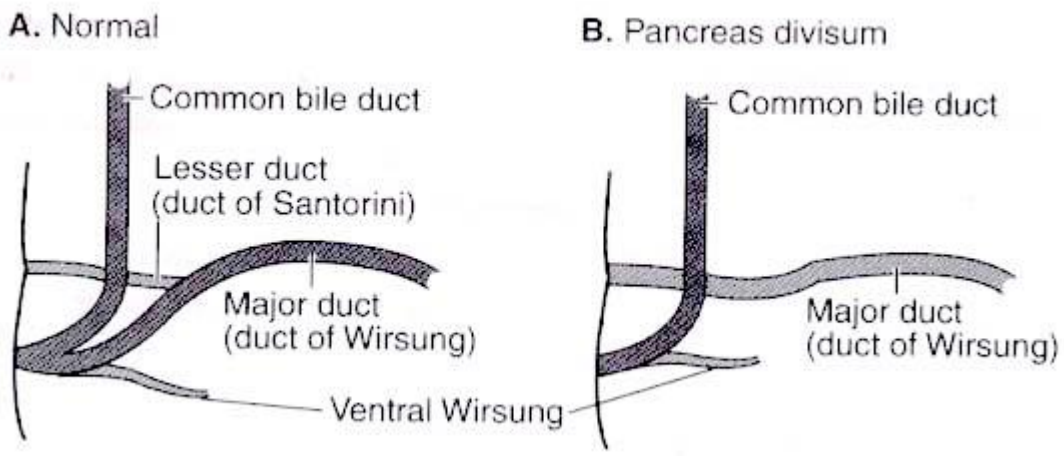

Fig 5.

Gross Anatomy

Pancreas is a retroperitoneal organ that lies in an oblique position. It slopes upward from the C-loop of the duodenum to the splenic hilum(Fig 6.).In an adult, the pancreas about15 to 20 cm long. It weighs 75 to 100 g.It situation being, so deeply in the abdomenand sealed in the retroperitoneum, explains the poorly localized and sometimes ill-defined nature with which pancreatic pathology presents.Pain associated

with pancreatitis often is characterized as penetrating through to the back due to its retroperitoneal location.

The situation of pathology within the pancreas is usually described in relation to four regions: the head, neck, body, and tail. The head of the pancreas is posterior to the transverse mesocolon and lies in the C-loop of the duodenum.Both renal veins,the right renal artery and the vena cava lies just behind the head of the pancreas. The Pancreatic neck lies directly over the portal vein. The superior mesenteric vein joins the splenic vein and continues toward the porta hepatis as the portal vein, at the inferior border of the pancreatic neck.

Usually the inferiormesenteric vein joins the splenic vein, near its junction with the portal vein.The superior mesenteric artery runs just to, left of the superior mesenteric vein and lies parallel to it. The head of the pancreas and uncinate process wrap around the right side of the portal vein and end posteriorly near the space between the superior mesenteric artery and superior mesenteric vein. Venous branches draining the head of pancreas and uncinate process enter along the posterior and right lateral sides of the portal vein. There are no anterior venous tributaries usually, so a plane can be easily developed between the pancreatic neck and the portal and superior mesenteric veins during resection of pancreas, unless the tumour invades the vein anteriorly. The common bile duct lies in a deep groove on the dorsal aspect of the head of pancreas until it passes through the parenchyma of pancreas to join the Wirsung’s duct at the ampulla of Vater. The body and pancreatic taillie just anterior to the splenic

vessels. The splenic vein runs in a groove on the dorsal aspect of pancreas and is fed by multiple fragile venous branches from the parenchyma of pancreas. These fragile branches should be carefully ligated while performing a spleen-sparing distal pancreatectomy. The splenic artery runs just superior and parallel to the splenic vein along the posterior superior edge of the pancreaticbody and tail. The splenic artery often is tortuous. The body of the pancreas is covered by peritoneum in its anterior surface. Once the gastro colic omentum is divided, the body and tail of the pancreas can be seen along the floor of the lesser sac, just posterior to the stomach.[6]

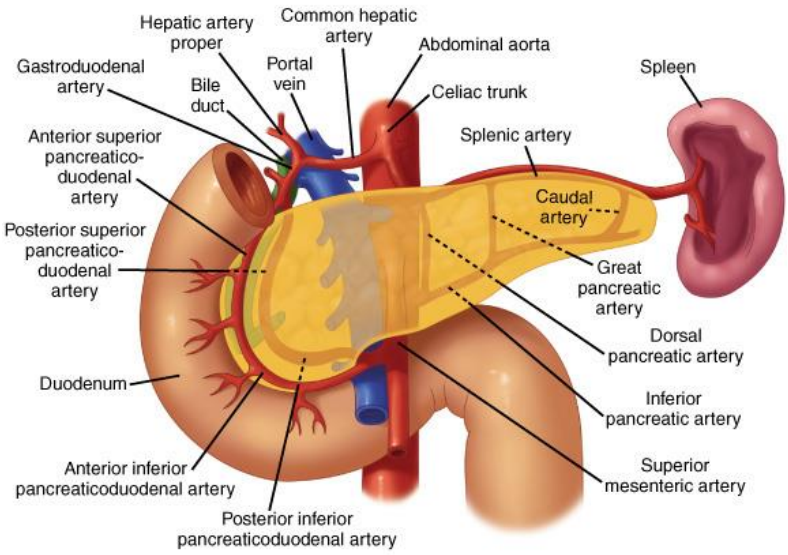

Fig 6.

3.2PHYSIOLOGY OF PANCREAS

The exocrine pancreas accounts for about 85% of the pancreatic mass, 10% of the gland is accounted by extracellular matrix and 4% by blood vessels and the major ducts, whereas only 2% of the gland is comprised of endocrine tissue. The exocrine and endocrine pancreas are sometimes thought as functionally separate, but different components of the organ are coordinated and allows an elegant regulatory feedback system, for hormone secretion andrelease of digestive enzymes. This complex system regulates the rate, type of digestion, and the distribution and processing of absorbed nutrients. The physical approximation of the exocrine pancreas and islets, the presence of specific islet hormone receptors on the plasma membranes of acinar cells, and the presence of an islet-acinar portal blood system facilitates coordination. Even though patients can live without a pancreas, when digestive enzyme andinsulin replacement are administered, the loss of this islet-acinar coordination leads to impairments in digestive function. Even though only 20% of the normal pancreas is required to preventinsufficiency, many patients undergoing pancreatic resection, the remaining pancreas is not normal, and pancreatic exocrine and endocrine insufficiency can develop with removal of smaller portions of the gland.

Exocrine Pancreas

The pancreas secretes approximately 500 to 800 mL per day of odourless,colourless, isosmotic,alkaline pancreatic juice. Pancreatic juice is a combination of duct cell and

acinar cell secretions. The acinar cells secrete amylase, lipase and proteases, enzymes responsible for digestion of all three food types: carbohydrate, fat and protein. The acinar cells are pyramidal in shape, with apices facing the lumen of the acinus. Near the apex of each cell are numerous enzyme-containing zymogen granules that fuse with the apical cell membrane (Fig.7). Unlike that of endocrine pancreas, where islet cells are specialized in secretion of one hormone type, individual acinar cells secrete all enzyme types. However, the ratio of different enzymes released is adjusted accordingly to the composition of digested food, through nonparallel regulation of secretion.

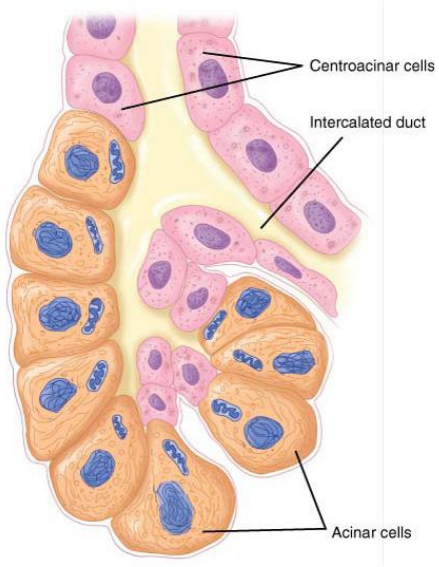

Fig 7.

Pancreatic amylase is released in its active form and helps to complete the digestive process already begun by salivary amylase. Amylase is the only enzyme secreted in its active form by the pancreas, and it hydrolyzes starch and glycogen to glucose, dextrin, maltose and maltotriose. These simple sugars are carried across the brush border of the intestinal epithelial cells by active transport. Gastric hydrolysis of protein yields peptides that enter the intestine and stimulate intestinal endocrine cells to release

cholecystokinin (CCK)-releasing peptide, CCK, and secretin,which then stimulate the pancreas to secrete enzymes and bicarbonate into the intestine.

The proteolytic enzymes require activation which are secreted as proenzymes. Trypsinogen is converted to trypsin (active form), by another enzyme, enterokinase, produced by the duodenal mucosal cells. The other proteolytic enzymes are in turn activated by trypsin. Trypsinogen activation is preventedwithin the pancreas by the presence of inhibitors which are also secreted by the acinar cells. Failure to express, pancreatic secretory trypsin inhibitor (PSTI) or *SPINK1*(normal Trypsinogen inhibitor), is a cause of familial pancreatitis.

Inhibition of the activation of Trypsinogenensures that the enzymes within the pancreas remain in an inactive state and are activated only within the duodenum. Trypsinogen is expressed in several isoforms, a missense mutation on the cationic Trypsinogen, or *PRSS1*, results in premature activation ofTrypsinogen within the pancreas. This results in two-thirds of cases of hereditary pancreatitis. Chymotrypsinogen is activated to form chymotrypsin. Carboxypeptidase A and B,Elastase and phospholipase are also activated by trypsin. Chymotrypsin, trypsin and elastase cleaves bond between amino acidswithin a target peptide chain, and Carboxypeptidase A and B cleaves amino acids at the terminal end of peptide chains. Individual amino acids and smalldipeptides are then transported into the intestinal epithelial cells actively.

Pancreatic lipase hydrolyzes triglycerides to fattyacid and 2-monoglyceride.Lipase is secreted in an active form. Colipase secreted by pancreas, binds to lipase, changing its molecularconfiguration and increasing its activity. Phospholipase A2 is secreted as a proenzyme and is activated by trypsin.This hydrolyzes phospholipids and requires bile salts for its action as all lipases. Cholesterol esterase and carboxylic ester hydrolase hydrolyzes neutral lipid substrates like triglycerides, esters of cholesterol and fat-soluble vitamins. The hydrolysed fat is then packed intomicelles for transport into the intestinal epithelial cells, where fatty acids are reassembled and packed inside chylomicrons for transportingthrough the lymphatic system into the bloodstream[7] (Table 1).

Table-1 Pancreatic Enzymes

Enzyme	**Substrate**	**Product**
Carbohydrate Amylase (active)	Starch, glycogen	Glucose, maltose, maltotriose dextrins
Endopeptidases	Cleave bonds between amino acids	Amino acids, dipeptides
Trypsinogen (inactive) $\xrightarrow{\text{Enterokinase}}$ Trypsin (active)		
Chymotrypsinogen (inactive) $\xrightarrow[\text{Trypsin}]{\text{Enterokinase}}$ Chymotrypsin (active)		
Proelastase (inactive) $\xrightarrow[\text{Trypsin}]{\text{Enterokinase}}$ Elastase (active)		
Exopeptidases Procarboxy peptidase A&B	Cleave amino acids from terminal end of peptide chains	—

(inactive) Enterokinase→Carboxypeptidase A&B (active)		
Fat Pancreatic lipase (active)	Triglycerides	2-Monoglycerides fatty acids
Phospholipase A2 (inactive) Trypsin→Phospholipase A2 (active)	Phospholipase	—
Cholesterol esterase	Neutral lipids	—

Endocrine Pancreas

There are nearly 1 million islets of Langerhans in a normal adult pancreas. They vary greatly in size from 40 to 900 m. Smaller islets are embedded more deeply in the parenchyma of the pancreas and larger islets are located closer to major arterioles. Most islets contain 3000 to 4000cells of five major types- alpha cells that secrete glucagon, Beta cells that secrete insulin, Delta cells that secrete somatostatin, Epsilon cells thatsecrete ghrelin, and PP cells that secrete PP [8](Table 2).

Table 2 Pancreatic Islet Peptide Products

Hormones	**Islet Cell**	**Functions**
Insulin	(beta cell)	Decreases gluconeogenesis, fatty acid breakdown,glycogenolysis, and ketogenesis Increased glycogenesis, protein synthesis
Glucagon	(alpha cell)	Opposite actions of insulin; increased hepatic glycogenolysis and gluconeogenesis
Somatostatin	(delta cell)	Inhibits GI secretion Inhibits action and

		secretion of all GI endocrine peptides Inhibits cell growth
Pancreatic polypeptide	PP (PP cell)	Inhibits secretion of insulin and pancreatic exocrine secretion. Facilitates hepatic effect of insulin
Amylin (IAPP)	(beta cell)	Counter regulates insulin secretion and function
Pancreastatin	(beta cell)	Decreases insulin and somatostatin release Increases glucagon release Decreases pancreatic exocrine secretion
Ghrelin	(epsilon cell)	Decreases insulin release and insulin action

3.3. INTRODUCTION TO AP

Acute pancreatitis is a potentially fatal disease.Acute pancreatitis is an acute inflammatory processwith variable involvement of the pancreas, regional tissuesaround the pancreas, or remote organ systems. The clinical courseranges from mild discomfort with minimal inflammation tosevere necrotizing pancreatitis, complicated by multiorgan failureand death. The most common etiologies are alcoholabuseand gallstones. The natural history is dependent on the degree of necrosis and inflammation. An acute attack is usually followedby completerecovery of function if the offending agent is identified and removed.

The pathogenesis of acute pancreatitis involves discrete intracellular events that cause premature activation of intra-acinar zymogen granules and generate therelease of proinflammatory and proapoptotic mediators. Understanding the natural history and specific roles of these cytokines may help develop therapies that can alter the course of severe pancreatitis and decrease its complications[9].

3.4. AETIOLOGY AND CLASSIFICATION

Acute Pancreatitis may be classified based on aetiology,pathology, severity of disease, or the presence of necrosis. Risk factors are summarized in Fig.8. In approximately 10–20% of patients, no aetiology is identified. Some of them may have microlithiasis and/or sphincter of Oddi dysfunction (SOD) as the aetiology of AP. With the increasing knowledge and understanding of the role of genetic abnormalities in hereditary and idiopathic chronic pancreatitis (CP), it is possible that these abnormalities will be implicated in idiopathic AP. Polymorphisms in inflammatory mediators may also influence disease severity.

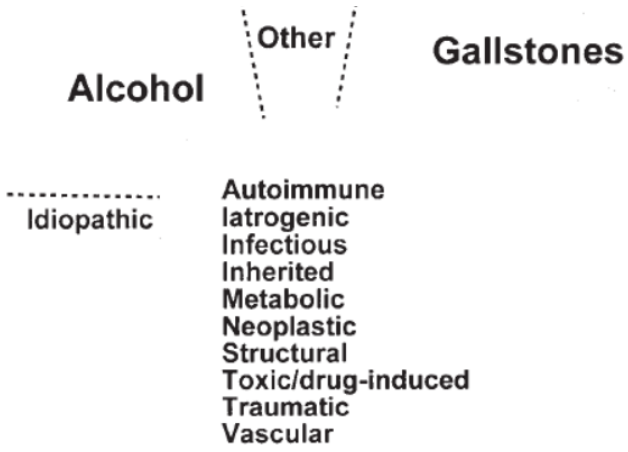

Fig 8.

Clinically, AP may be classified as mild or severe disease[10]. SAP is associated with organ failure and/or local complications, such as abscess,necrosis or pseudocyst. Approximately 10–20% of patients develop severe disease. Various clinical criteria

(e.g. Ranson's or Acute Physiology and Chronic Health Evaluation [APACHE]), serum markers (e.g., interleukin [IL]-6, C-reactive protein, and trypsinogen activation peptide) and imaging modalities (CECT) have been used to predict severity. Complicated courses are more common in SAP with mortalityrates from 5 to 20%[11] . In contrast, mild Acute Pancreatitis is the more frequent presentation and has minimal or transient organ dysfunction and uneventful recovery.

The presence of necrosis is the single best predictor of outcomeduring AP. Pancreatic necrosis is a focal or diffuse area of nonviableparenchyma, typically associated with peripancreatic fatnecrosis, which on a contrast CT scan is observed as non-enhanced pancreatic parenchyma. The morbidity andmortality can be predicted by the degree of necrosis. Approximately 30% of patients with pancreatic necrosisdevelop infected necrosis with a mortality of 6 to 40% and a morbidityof more than 80%.

The Revised Atlanta Classification

The revisions of OAC(Original Atlanta classification) and definitions have been updated recently as the Revised Atlanta classification (RAC) [12] according to which the diagnosis of AP requires two of the following three features: (1) abdominal pain consistent with AP; (2) characteristic findings of acute pancreatitis on contrast-enhanced computed tomography (CECT) and less commonly magnetic resonance imaging or trans abdominal ultrasonography; and (3) serum lipase activity (or amylase activity) at least three times greater than the upper limit of normal.[12].

This classification redefines severity of AP into 3 categories mild, moderate and severe, and also morphologically describes fluid collections occurring following AP [12] In addition, based on the CECT criteria, 2 distinct types of AP: Acute necrotizing pancreatitis (ANP) and acute interstitial oedematous pancreatitis have been described. ANP is further subdivided into pancreatic parenchymal necrosis aloneperipancreatic necrosis alone and pancreatic parenchymal and peripancreatic necrosis [12, 13].
The classification of severity is primarily based on presence of organ failure (OF) which is assessed by modified Marshall scoring system, and local or systemic complications (exacerbation of co-morbid conditions) (Fig 9.). SAP is characterized by persistent Organ Failure which is indicated by presence and persistence of systemic inflammatory response syndrome (SIRS). Persistent Organ failure may involve single or multiple organs and such cases usually have one or more local complications. These patients are at an increased risk of death, with a mortality reported as high as 36–50% [12,14]; which may increase further with the development of infected necrosis [15, 16].

In Revised Atlanta Classification the description of fluid collections and their terminology has been made precise and it provides the standardization which had been a source of controversy in the past few years (Fig 10)

A. Mild acute pancreatitis:
(i) No organ failure
(ii) No local or systemic complications
B. Moderately severe acute pancreatitis:
(i) Organ failure that resolves within 48 h (transient organ failure) and/ or
(ii) Local or systemic complications without persistent organ failure
C. Severe acute pancreatitis : Persistent organ failure (> 48 h)
(i) Single organ failure
(ii) Multiple organ failure

Fig 9. Revised Atlanta classification.

Type of Collection	Type of Pancreatitis	Description	CECT Criteria
Acute peripancreatic fluid collection (APFC)	Acute interstitial edematous pancreatitis	Areas of peripancreatic fluid seen within the first 4 weeks after onset. No associated necrosis	Homogeneous fluid density collection Confined by normal peripancreatic fascial planes. No definable wall encapsulating. Adjacent to pancreas (no intrapancreatic extension)
Pancreatic Pseudocyst	Acute interstitial edematous pancreatitis	Usually occurs more than 4 weeks after onset	Well circumscribed, usually round or oval Homogeneous fluid density. No non-liquid component Well defined wall; completely encapsulated
Acute Necrotic collection (ANC)	Acute necrotizing pancreatitis	Usually occurs less than 4 weeks after onset	Heterogeneous, non-liquid density of varying degrees (some appear homogeneous early in the course). No definable wall encapsulating the collection Location: Intrapancreatic and/ or extrapancreatic
Walled off-necrosis (WON)	Acute necrotizing pancreatitis	Usually occurs more than 4 weeks after onset	Heterogeneous, liquid and non-liquid density with varying degrees of loculations (some may appear homogeneous). Well defined wall; completely encapsulated. Location: Intrapancreatic and/or extrapancreatic

Fig 10.Types of fluid collections (Revised Atlanta Classification)

SPECIFIC ETIOLOGIES

GALLSTONES

Gallstones are implicated in majority of Acute Pancreatitis cases. Although it is common, they rarely cause pancreatitis. It is estimated that over a 20- to 30-year period, the risk for developing biliary pancreatitis is approximately 2%in patients with asymptomatic gallstones. Smaller gallstones, particularly those that are smaller than 5

mm in size, increase the risk of Acute Pancreatitis. Patients with microlithiasis can present with recurrent episodes of “idiopathic” AP.

ALCOHOL

Alcoholic pancreatitis presents as AP, although in most patients, it occurs in the presence of already established chronic pancreatitis (CP).It is the most common cause of recurrent pancreatitis. The incidence of alcoholic pancreatitis is low (about 5%) in alcohol abusers. This suggests that in addition to alcohol ingestion, other factors, such as environmental influences or genetic background, may affect patient susceptibility. Abnormal SOD spasm, direct toxic effect of alcohol and its metabolites and obstruction of the small ducts by proteinaceous material are some physiological mechanisms which contribute to the development of alcoholic pancreatitis.

HYPERLIPIDEMIA

Hyperlipidaemia is a cause of AP and CP. Triglyceride levels more than 1000 mg/dL is usually required for the development of AP.

DRUGS

Drugs are a rare cause of AP. Various medications have been implicated in AP. 6-mercaptopurine,Azathioprine, and 2’, 3’- dideoxyinosine have an unquestionable association. Weaker association is seen with drugs like angiotensin-converting enzyme inhibitors, and tetracycline.

ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY

Acute Pancreatitis is the most common complication of ERCP. Prospective studies have documented an incidence of approximately 5% with most cases being mild pancreatitis.

3.5. PATHOGENESIS OF AP

The syndrome of AP represents a series of pathological events. The initial pathology is likely to involve either the acinar cell or reduced blood flow. Once initiated, the process can involve the whole pancreas, its surrounding tissues, and can cause a systemic reaction harming many organs. Much of our information is derived from experimental animal studiesas human pathological material is rarely available from early cases of AP.

ACINAR CELL EVENTS

Pancreatic acinar cells form approximately 95% of the exocrine mass. In response to an initiating insult, the acinar cell mounts three key pathological responses: intracellular zymogen activation, inhibited secretion, and the generation and release of proinflammatory and proapoptotic mediators (Fig.11).

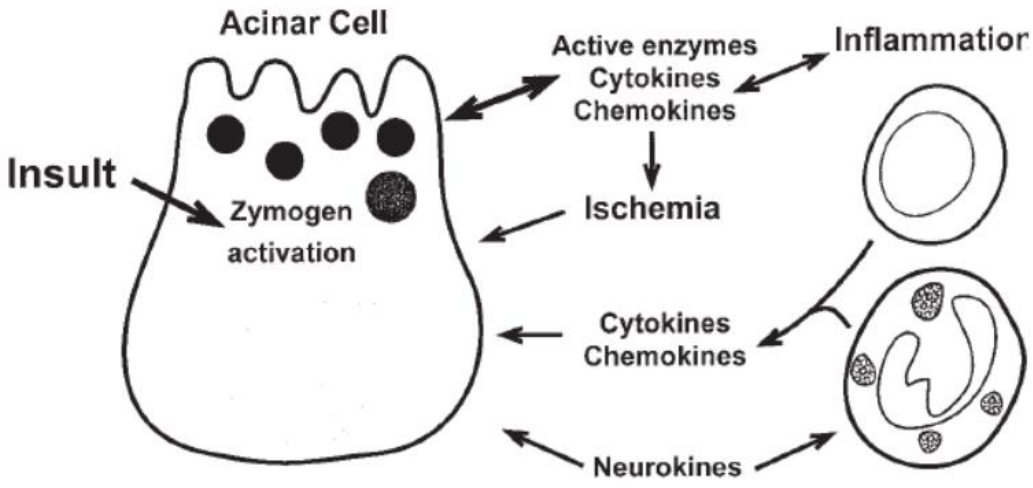

Fig 11.Early and late cellular events in the pathogenesis of acute pancreatitis.

ZYMOGEN ACTIVATION AND INHIBITION OF SECRETION

Most of the pancreatic digestive enzymes, including all proteases,are synthesized and stored as inactive proenzymes (zymogens).Within the first minute to hours of an episode of AP; zymogens are activated within the pancreatic acinar cell [17]. Zymogens that have leaked into the interstitium may also be activated at later stages. The mechanisms responsible for the acinar cell activation have not yet been fully defined. Howeverseveral factors have been consistently identified by experimental models. Many of the physiological responses of the acinar cell to neurohumoral stimuliis mediated by elevations in cytosolic calcium.

When acinar cells are stimulated pathologically, their zymogen and lysosomal contents colocalize, whereuponcathepsin B converts trypsinogen to trypsin. Increased cytosolic calcium is required for colocalization. Trypsin mediates the permeability of these colocalized organelles. Cathepsin B and other contents of these colocalized organelles are released into the cytosolonce trypsin has permeabilized the cells. Cathepsin B also activates apoptosis by causing cytochrome c to be released from the mitochondria. Cathepsin B–induced activation of the Bcl-2 family of proteins helps the release of cytochrome c from the mitochondria. Heat shock protein 70 (HSP70) overexpression attenuates cytosolic calcium (Ca 2+), thus preventing colocalization and thesubsequent events that lead to acinar cell injury and death.(Fig 12)

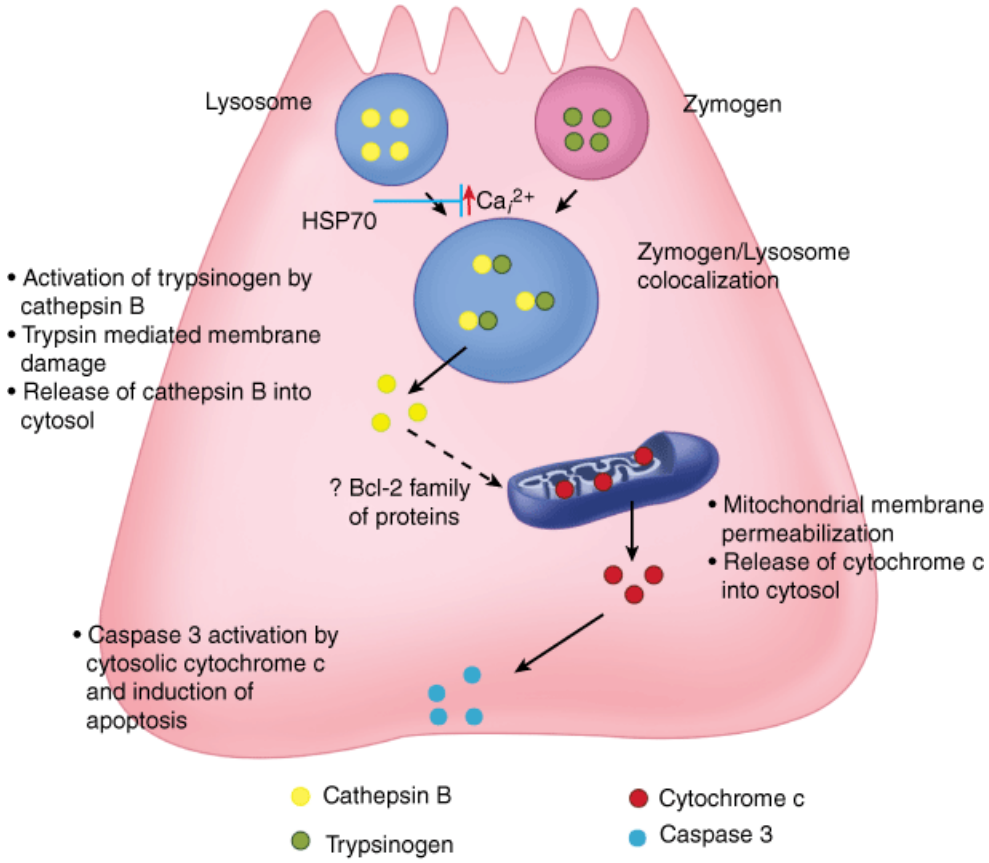

Fig 12. Schematic representation of the pancreatitis hypothesis.

The enterokinase (brush border enzyme), first converts trypsinogen to trypsin and then, the other zymogens are activated by trypsin. Since the pancreas does not contain enterokinase, some other mechanism must be responsible for activation.

The leading candidates are activation of trypsinogen by the lysosomal enzyme, cathepsin B, or trypsinogen auto activation[18]. Several mechanisms permit cathepsin B to mix with trypsinogen. First, even though in the Golgi complex,the lysosomal enzymes are usually separated from digestive zymogens, the pancreas directs some of the lysosomal enzymes to the secretory compartment. Second, organelles containing the two enzyme familiesmay fuse[19].

Activation of enzyme alone may not be sufficient to cause acinar cell damage. The decreased secretion of proteins from theacinar cellmay have a critical role in disease which is observed at the onset of pancreatitis. The disruption of theapical actin cytoskeleton may result inreduced secretion. Some conditions that cause zymogen activation butleave the secretion intact do not cause acinar cell injury.Thus, both retention of enzymes and enzyme activation in the acinarcell may be required to initiate disease.

The release oftrypsin into the interstitium has a unique role in causing the severepain associated with Acute Pancreatitis. Trypsin may specifically stimulate proteaseactivatedreceptors on nerves that carry pain sensation. Sincezymogen activation appears to be a very early feature of the disease, theuse of protease inhibitors therapeutically may be limited to prophylaxis(e.g., for ERCP-induced AP). The importance of zymogenactivation in the pathogenesis of AP is underscored by theobservation thatmutations in cationic trypsinogen can cause some forms of hereditary pancreatitis and thereby itmight enhance its activation orprolong its activity[20].

CYTOKINE AND CHEMOKINE GENERATION

Inflammation and cell death are two key features of AP. Neutrophilrecruitment and activation are early features of disease and they correlate withthe disease severity. Soluble factors, such as tumour necrosis factor(TNF)-alpha and platelet-activating factor, are generated by the acinar cellsand stimulate inflammation. Expression of

intracellular adhesionmolecule-1 and selectins in the endotheliumpromotes inflammatory cell adhesion.Substance P(neurokine) may also have a key role in disease. Mononuclear cells may contribute to injury,even in acute disease. Cytokinesgenerated by the acinar cell (e.g., TNF-alpha) can also induce programmedcell death (apoptosis). Release of these soluble factors from the pancreasmay also beresponsible for the lung injury associated with severe pancreatitis[21,22]. Multiple cytokines that cause distinct patterns of organ injury are released, which makes it unlikely that inhibition of asingle pathway will be an effective disease treatment.

PANCREATIC AND PERIPANCREATIC EVENTS

EDEMA

Increased tissueoncotic pressure and increasedcapillary permeability potentially lead to early pancreatic oedema. Such changescontribute to the decreased pancreatic blood flowbydiminishing intravascular volume and the compression of vascularstructures.

VASCULAR CHANGES AND FREE RADICAL GENERATION

Endothelial injury, vasospasm, and vascular thrombosis can all occurin AP. Two deleterious outcomes can occur with changes in pancreatic perfusion. Vasospasm with later increase in circulation can cause perfusion–reperfusion injury and free radical generation. Loss ofperfusion and ischemia can lead directly to cell death. Even though there is a strong theoretical and experimental basis for the implementation of free radicals in AP, thereis little clinical support for the use of antioxidant therapy.

CHANGES IN PARACELLULAR CELL PERMEABILITY

Loss of the cell structures which form tight seals, known as “tight junctions” occur in the acinar and duct cells. This early event occurring within first 30minutes is associated with breakdown of the actin cytoskeleton which is ananchor for the tight junctions. These disruptions allow the pancreaticduct contents to leak into the interstitial space. These changes contributeto the very rapid increase in serum levels of pancreaticenzymes and rapid decrease in secretions of pancreas observed at theonset of disease. Also, zymogens that enter the interstitial spacemay undergo activation.

CELL DEATH

Two mechanisms of cell death are observed in AP: necrosisand apoptosis. The factors mediating thetwo mechanisms of death are not clearly understood. Moresevere forms of pancreatitis may be however more strongly associated withnecrotic death than apoptotic cell death. Necrosis is the earliestand is most prominent in adipose tissue in humans. Injured adipocytes may be arich source of harmful cytokines (TNF-alpha) and provide substrates(triglycerides) for the generation of harmful free fatty acids. A unique form of necrosis after injury; instead of dying, is undergone by the acinar cell, the cell may respond to injury by pinching off their apical zymogengranule-rich region. This leaves the acini filled with flattened cells—theseglandular structures are known as tubular complexes. This response provides a scaffold for rapid regeneration. Similarly, high levelsof the pancreatitis-associated protein and the pancreatic

stoneprotein generated during the initial days of Acute Pancreatitis may have arole in reconstitution. Generally, exocrine and endocrine structure andfunction fully recovers from an episode of AP. With severe disease,however some deficiency in function may be detected upto 1 year.

SYSTEMIC EVENTS

Two major processes lead to death in AP, early deaths are caused bymultiorgan failure and later deaths by OF and/or infectednecrosis. The SIRS is alsoassociated with severe pancreatitis. The lungs are particularly more sensitive tothis injury, and the development of ARDSoften indicates severe disease. SIRS and OF can be presentupon admission but are often reversible. Even though the presence of someOF or SIRS upon admission has a worse prognosis, those patients with deteriorating organ functionor persistent SIRS have been observed to have the highest mortality. Therelease of these inflammatory cytokines, chemokines, and neurokines lead to systemic effects.

3.6. CLINICAL FEATURES

Patients with AP usually present with suddenonset of upper abdominal pain, nausea, and vomiting. Approximately 80% ofpatients have interstitial pancreatitis with mild-to-moderate symptoms,and 20% have life-threatening necrotizing disease. Careful clinicalassessment, the judicial use of biochemical tests and radiologicalimaging helps the practitioner to differentiate AP from other causesof acute abdomen and to assess the severity of disease[23-29].

History and Physical Exam

AP is characterized by abdominal pain located in the epigastric region, often radiating to the mid-thoracicportion of the back. Pain reaches maximum intensityusually within 20minutes but can have a more gradual onset. The pain in AP is usuallysharp, constant, lasts for hours to days, severe enough to forcethe patient to visit the emergency room.

In mild cases of AP, there may be decrease in pain when sitting or leaning forward in comparison to lying flat.

Nausea and vomiting with or without low-grade fever are the mostcommonly associated symptoms [23,26,27].

Inpatients with alcohol-induced pancreatitis,a recent history of binge drinking may be frequently elicited. The concomitant presenceof jaundice and high-grade fever

strongly suggests choledocholithiasisas the aetiology of AP, complicated by coexistent cholangitis[23-29].

Lesscommonly, confusion, respiratory failure and even coma are the mainpresenting features, which are common manifestations of severenecrotizing pancreatitis. In rare cases, abdominal pain may be absent,leading to a delayed or missed diagnosis[23].

Abdominal distension,tenderness, guarding, and absent bowel sounds are the usual findings on a physical examination. Low grade fever is generally associatedwith AP. High-grade temperature may indicatethe development of infected pancreatic necrosis and associated fluidcollection or cholangitis, particularly if jaundice is present [23,24,27,28].

SAP is often complicated by massive lossof fluid into retroperitoneal spaces. Hypotension and tachycardiaare some of the earliest clues for a moderate-to-severe attack of pancreatitisand are also markers for significant early depletion of intravascular volume. These may soon progress to hypovolemic shock caused byincreased vascular permeability, vasodilatation, and haemorrhage [23].

Dyspnoea and tachnypnea are also common in severe pancreatitis, dueto associatedpleural effusions,splinting from the sub diaphragmatic inflammatory process or pulmonary capillary leak syndrome. Pleural effusion is usually found on theleft side but can be bilateral.

Rare clinical findings include ecchymosis of the umbilicus(Cullen’s sign) or flanks(grey turner sign),peripheral subcutaneous fat necrosis, and polyarthritis. Classically, darkskin discoloration of the per umbilical areas and flanks occurring because of haemorrhageis described with severe and haemorrhagic pancreatitis; howeverthese physical findings may result from any type of retroperitonealbleeding[28].

3.7. DIFFERENTIAL DIAGNOSIS

Differential diagnosis of Acute pancreatitis [30]

Mild attack

x Biliary colic or acute cholecystitis

x Complicated peptic ulcer disease

x Acute liver conditions

x Incomplete bowel obstruction

x Renal disease

x Lung disease (example, pneumonia or pleurisy)

Severe attack

x Perforated or ischaemic bowel

x Ruptured aortic aneurysm

x Myocardial infarction

3.8. RISK STRATIFICATION IN PANCREATITIS

Early evaluation of severity of AP is essential to allow the clinician topredict the patient's clinical course, determinethe need for intensive care unit admission and estimate prognosis. SAP can be predictedby clinical criteria, serum markers,multiple factor scoring systems andradiographic features. Most of these scoring systems have been developedto assist the clinician in assessing the severity of AP. Themost commonly used systems are the Ranson criteria (Fig 13,14.), modifiedGlasgow scoring system(Fig 15), and the Acute Physiology And ChronicHealth Evaluation II (APACHE II)[31-33]. The Modified Glasgow System and Ranson Criteria rely on acollection of clinical and biochemical variables measured within thefirst 48 hours of admission.

They are however very cumbersome and complex for quick evaluation. In 2008, the Bedside Index for Severity in Acute Pancreatitis (BISAP) score(Fig 16.) was proposed for the early recognition of patients at risk of mortality.

This scoring system is comprised of five variables: Impaired mental status, development of systemic inflammatory response syndrome, age > 60 years,blood urea nitrogenlevel > 25 mg/dl and presence of pleural effusion [34,35]. BISAP is more convenient to use with fewer items when compared with traditional scoring systems.

More novel serum tests have also been evaluated. C-reactive protein(an acute-phase reactant) is widely available,cheap and commonly usedin Europe to measure the

severity of AP. A level of 150 mg/L of C-reactiveprotein has been proposed as a criterion for distinguishing mild APfrom SAP[36]. Other markers like trypsinogen activation peptide,polymorph nuclear elastase and interleukin-6 have been shown in Research studies to be of value in predicting severe necrotizing pancreatitis,but commercial assays are not yet available for clinical use.

Ranson Criteria

For Acute Non-Gallstone Pancreatitis	
Upon admission:	
1. Age	>55 years
2. WBC	>16,000/mm^3
3. Glucose	>200 mg/dL
4. LDH	>350 IU/L
5. AST	>250 IU/L
Within 48 hours:	
1. Drop in HCT	>10%
2. Serum Ca	<8 mg/dL
3. Base deficit	>4 mEq/L
4. Increase BUN	>5 mg/dL
5. Fluid deficit	>6 L
6. Arterial PO_2	<60 mmHg

Fig 13.

For Acute Gallstone Pancreatitis	
Upon admission:	
1. Age	>70 years
2. WBC	>18,000/mm^3
3. Glucose	>220 mg/dL
4. LDH	>400 IU/L
5. AST	>440 IU/L
Within 48 hours:	
1. Drop in HCT	>10%
2. Serum Ca	<8 mg/dL
3. Base deficit	>5 mEq/L
4. Increase BUN	>2 mg/dL
5. Fluid deficit	>6 L

Fig 14.

Modified Glasgow System

Arterial PO_2	<60 mmHg
Serum albumin	<3.2 g/dL
Serum Ca	<8 mg/dL
WBC	>15,000/mm^3
AST	>200 IU/L
LDH	>600 IU/L
Glucose	>180 mg/dL
BUN	>45 mg/dL

Fig15.

BISAP SCORE

- BUN >25 mg/dL (8.9 mmol/L) (1 point)
- Abnormal mental status with a GCS<15 (1 point)
- Evidence of SIRS (1 point)
- Patient age >60 years old (1 point)
- Imaging study reveals pleural effusion (1 point)

0 to 2 Points:	Lower mortality (<2 percent)
3 to 5 Points:	Higher mortality (>15 percent)

Fig 16.

3.9. INVESTIGATIONS OF AP

Laboratory Tests

The diagnosis of AP is usually suspected based on the appropriateclinical features and is confirmed by laboratory and imaging tests.Leakage of pancreatic enzymes into thecirculation is a hallmark of AP.Although lipase and amylase constitute a small fraction of all pancreaticenzymes, they are the quickest and the easiest enzymes to measure.Typically, the elevation of serum amylase in Acute Pancreatitis is more than threefold of thenormal values.

Amylase levels are usually increased within a few hours ofdisease onset, but they may be cleared from the serum rather quickly.Serum amylase usually remains elevated for 3–5 days in uncomplicatedAP. Because many conditions can cause hyperamylasemia (Table 3),the specificity of elevated serum amylase level is less than 70%.

Table 3.-**Causes of Increased Serum Amylase Activity**

- Pancreatic diseases

Acute pancreatitis
Pancreatic cancer

- Abdominal emergencies

Acute cholecystitis
Common bile duct obstruction
Perforated viscous
Intestinal ischemia
Acute appendicitis
Ruptured ectopic pregnancy and acute salpingitis

- Salivary gland diseases
- Renal insufficiency
- Macroamylasemia
- Diabetic ketoacidosis
- HIV infection/AIDS

- Sphincter Oddi stenosis or spasm
- Drugs: Morphine

Measurements of urinary amylase and theamylase-to-creatinine ratio may be helpful to distinguish AP from othercauses of hyperamylasemia, but such measurements are infrequentlyemployed [37].

In many cases, during pancreatitis urinary clearance of pancreatic enzymes from the circulation increases; hence, urinary levels may be more sensitive than serum levels. For the above reasons, it is recommended that amylase concentrations to be measured in the urine. Urinary amylase levels usually remain increased for manydays after serum levels have returned to normal. In patients with severe pancreatitis associated with significant necrotic damage, the pancreas may not release large amounts of enzymes into the circulation [38].

Measurements of serum amylase isoenzyme may improve the diagnosticaccuracy of serum amylase alone. Less than half ofall circulating amylase originates in the pancreas, whereas the remainderis of salivary origin in healthy people. Serum pancreatic isoamylase (P-isoamylase)accounts for the elevated total serum amylase level in Acute Pancreatitis and it tends topersist for several days. However, pancreatic isoamylase can be elevated in renal insufficiency and in some other gastrointestinal disorders, makingit difficult to diagnose Acute Pancreatitis based on P-isoamylase levels alone withoutadditional diagnostic parameters [39].

The elevation of serum amylase usually parallels the serum lipase level in Acute Pancreatitis. However, the serum lipase level often remains elevatedlonger, making it more useful to diagnose pancreatitis after symptoms have subsided. Lipase is considered more specific than amylase for pancreatic tissue injury, despite the fact that it is also produced by manyother gastrointestinal tissues. Another potential advantage of lipase is that it is generally not elevated in diabetic ketoacidosis or macroamylasemia[23].

Both lipase and amylase are widely and rapidly available from hospital laboratories. In practice, combining the measurement of serum lipase and amylase levels enhances the diagnostic accuracy for Acute Pancreatitis. A normal lipase or amylase level makes the diagnosis of Acute Pancreatitis unlikely, except in the presence of hyperlipidaemia.

Very high levels of serum triglyceride (one among the causes of Acute Pancreatitis) can interfere with the laboratory assay for both lipase and amylase. In such scenarios dilution of the serum may be necessary to reliably measure the elevations of lipase oramylase. In some patients with chronic pancreatitis, acute abdominal pain can be the result of focal acute inflammationof the gland, and serum amylase and lipase levels may remain normal[27,28].

It is to be noted that a correlation has not been found betweendegree of serum lipase and amylase elevation with the severity of Acute Pancreatitisor amount of structural damage of the pancreas [36].

Pancreatic enzymes, such as serum trypsin, chymotrypsin, ribonuclease , phospholipase A2, and elastase have been reported to be elevated in AP, but to measure these enzymes, assays are not readily available for clinical use, and their specificity has not been defined [24,27,36].The use of other available clinical laboratory tests may help in determining the aetiology of Acute Pancreatitis. For example, elevated bilirubin and hepatic transaminases, particularly alanine aminotransferase more than 80 IU/L should raise the suspicion of gallstone pancreatitis [23-27].

IMAGING

ULTRASONOGRAPHY

Transabdominal ultrasonography is relatively inexpensive,widely available and quite safe. Unfortunately, pancreatic imaging by ultrasound has limitations from overlying bowel gas and surrounding fat planes, which tend to be exaggerated in the acutely inflamed pancreas owing to ileus and peripancreatic edema. Thus the sensitivity and specificity of this modality for diagnosing AP is low[23]. Nonetheless, transabdominal ultrasonography is useful in the early stages of Acute Pancreatitis to search for gallbladder sludge orstones, to evaluate the cause for dilation of the common bile duct caused by choledocholithiasis, and analyse for other causes of severe abdominal pain.

COMPUTED TOMOGRAPHY SCAN

The computed tomography scan(CT), particularly when done withmultidetector orhelicaltechnology, is a valuable tool in the management and diagnosis of Acute Pancreatitis. However, every patient with AP does not require aCT scan. CT is mainly indicated if the initial diagnosis is in doubt orfor prognostic purposes in severely ill patients. The role of CT is both to exclude other intra-abdominalpathologies that can mimic AP (e.g., a perforated viscus) and to document the findings that confirm the diagnosis of AP.

CT scan findings supporting the diagnosis of Acute Pancreatitis include irregularity of the pancreatic contour with obliteration of the peripancreatic fat planes, segmental or diffuse enlargement of the pancreas, areas of hypo density within the pancreas, and ill-defined fluid collectionsin the pancreas or outside the gland in the Para renal spaces orlesser sac.

The frequency of these findings varies according to the severity of pancreatitis,and these findings do not require intravenous contrast CT to be identified.Intravenous contrast-enhanced computed tomography (CECT) ismainly used to differentiate interstitial pancreatitis from pancreatic necrosis or to monitor the complications in selected cases (i.e.,ratherthan simply confirming a diagnosis, helps in estimating prognosis and management of patients with Acute Pancreatitis).(Fig 17.)
At present, it is recommendedthat CECT be obtained 3–4 days after the onset of SAP for optimalassessment of pancreatic necrosis[32].

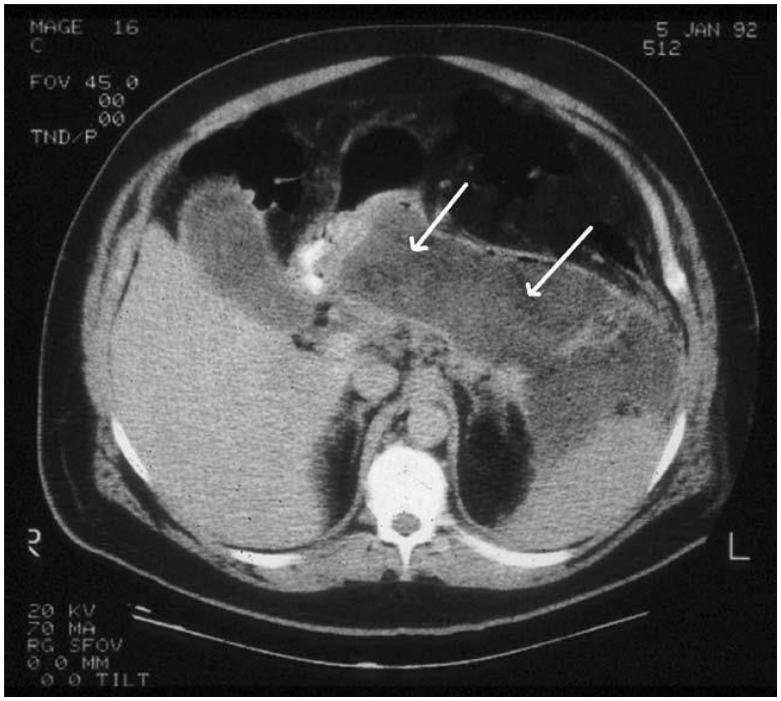

Fig 17.A CT scan demonstrating a large area of necrosis as evidenced by the lack of contrast enhancement after intravenous contrast administration

CT SEVERITY INDEX

The **CTSI** is based on findings from a CT scan with iv contrast to assess the severity of acute pancreatitis. The severity of CT findings correlates well with clinical indices of severity.

The **CT SEVERITY INDEX** sums two scores:

- Balthazar score: grading of pancreatitis (A-E)
- grading the extent of pancreatic necrosis

CTSI

Grading of pancreatitis (Balthazar score)

- A: normal pancreas: 0

- B: enlargement of pancreas: 1
- C: inflammatory changes in pancreas and peripancreatic fat: 2
- D: ill-defined single peripancreatic fluid collection: 3
- E: two or more poorly defined peripancreatic fluid collections: 4

Pancreatic necrosis

- none: 0
- ≤30%: 2
- >30-50%: 4
- >50%: 6

The maximum score that can be obtained is 10.

Treatment and prognosis

The CTSI is the sum of the scores obtained with the evaluation of pancreatic necrosis and the Balthazar score:

- 0-3: mild acute pancreatitis
- 4-6: moderate acute pancreatitis
- 7-10: severe acute pancreatitis

ENDOSCOPIC RETROGRADE CHOLANGIOPANCREATOGRAPHY

ERCP has norole in diagnosing Acute Pancreatitis. When compared to traditional medical treatment alone, therapeutic application of ERCP in moderate-tosevereacute gallstone pancreatitis has been shown by several controlledclinical trials to lower mortality andmorbidity. ERCP is also utilizedin the differential diagnosis and elective treatment of recurrent unexplainedpancreatitis secondary to sphincter Oddi dysfunction, pancreaticdivisum, and microlithiasis [40-42].

ENDOSCOPIC ULTRASOUND

The diagnostic role of EUS in Acute Pancreatitis is stillevolving; it is not easily available in all institutions. In recent studies,the immediate application of EUS for suspected biliary AP may aidin the diagnosis of gallstone pancreatitis, thereby helping to triage patients for therapeutic ERCP with endoscopic sphincterotomy andstone removal[43].

3.10. MANAGEMENT OF AP

Treatment

The severity of AP covers a broad spectrum of illness, ranging from the mild and self-limiting to the life-threatening necrotizingvariety. Hospitalization of the patient with suspected acute pancreatitis for observation and diagnostic study is usuallymandatory regardless of severity. Patients with moderate to severe disease should be transferred to the intensive care unit forobservation and maximal support, upon confirmation of the diagnosis. The initial treatment most importantlyis conservative intensive care with the goals of oral fluid and food restriction, replacement of electrolytes and fluids parenterally as assessed by urinary excretion,central venous pressure and control of pain. Most experts recommend broad-spectrum antibiotics insevere acute pancreatitis, or when signs of infection are present, (e.g., imipenem) and carefulsurveillance for complications of the disease[44](Fig 18).

Mild pancreatitis

Treatment of mild pancreatitis is supportive. Patients require hospital admission, where they should receive intravenouscrystalloid fluids and appropriate analgesia and should stop all oral intake. Most patients will require opiate analgesia,although this may cause the sphincter of Oddi spasm, there is no evidence that this affects the outcome of the disease. The severe pain of acute pancreatitis results in ongoing cholinergic discharge whichprevents the patient from resting and also stimulates pancreatic and gastric secretion. Therefore, management of pain is of great importance. Administration of meperidine,buprenorphine, procaine hydrochloride, and pentazocine are all of value in controlling abdominal pain.

A NG tube may be helpful if vomiting is severe. In the absence of coexisting infectionsantibiotics are of no benefit.Investigations are limited to the ultrasonography and initial blood tests when gall stones are suspected. Most patients will recover in 48-72 hours, and fluids can be restarted once abdominal pain and tenderness are resolving[30].

A low-fat, low-protein diet is advocated as the initial form of nutrition following an attack of acute pancreatitis[44].

Severe pancreatitis

For close monitoring of patients with severe pancreatitis, they should be admitted to anintensive care or high dependency unit.Adequate resuscitation of hypovolemic shock withlarge volumes of fluids over the first twenty-four - forty-eight hours remains the cornerstone of management. To restore circulating volume,resuscitation is mainly with crystalloids but colloids may be required.Progress is monitored by ensuring that urine output is adequate (> 30 ml/hr.). Measurement of pulmonary arterial or central venous pressure may be required, particularly in patients withcardiorespiratory compromise.

Patients who develop renal failure and adult respiratory distress syndrome requiredialysis andventilation.The role of prophylactic antibiotics in severe pancreatitisremains unclear, but antibiotics with good penetration into pancreatic tissue (such as high dose cefuroxime and imipenem) have shown amarginal benefit inrecent randomised trials. Patients with severe gallstone pancreatitis and biliary

sepsisor obstruction benefit from ERCP and removal of stones from thecommon bile duct within the first 48 hours of admission.

However, in patientswithout biliary obstruction,the benefit of sphincterotomy is equivocal. No effective drug has beendeveloped to prevent the development of severe pancreatitisdespite intensive search.

Initial clinical trials of several new drugs including antagonists of PAF (Lexipafant) and free radical scavengers that may limitpropagation of the cytokine cascade have been disappointing buthold theoretical promise[30].

When deterioration occurs after the first week,the possibility of infection inthe necrotic process should be considered. Infection can usually beconfirmed by CT guided fine needleaspiration. Patients with infected pancreatic necrosis have a 70%mortality and require surgical debridement (necrosectomy). In patients without infection,the role of necrosectomy is unclear.Several new approaches are being investigated, including the use ofenteral rather than parenteral nutrition, which may reduce gutpermeability and bacterial translocation and limit infection inthe necrotic pancreas and the use of minimally invasive necrosectomy and lavage.

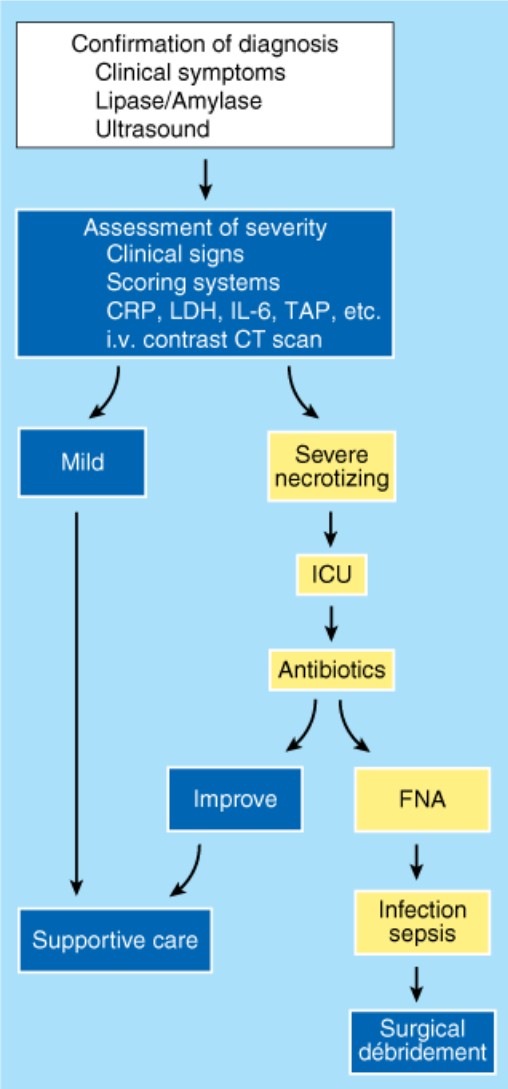

Fig 18.Algorithm for managing acute pancreatitis

3.11. COMPLICATIONS OF AP

Complications of Acute Pancreatitis[44]

I. Local

A. Pancreatic phlegmon

B. Pancreatic abscess

C. Pancreatic pseudocyst

D. Pancreatic ascites

E. Involvement of adjacent organs, withfistula formation, thrombosis, mechanicalObstruction, obstructive jaundice, haemorrhage, orbowel infarction.

II. Systemic

A. Pulmonary

1. Pneumonia, atelectasis

2. Acute respiratory distress syndrome

3. Pleural effusion

B. Cardiovascular

1. Hypotension

2. Hypovolemia

3. Sudden death

4. Nonspecific ST-T wave changes

5. Pericardial effusion

C. Hematologic

1. Hemoconcentration

2. Disseminated intravascular coagulopathy

D. GI haemorrhage

1. Peptic ulcer

2. Erosive gastritis

3. Splenic vein or Portal vein thrombosis with varices.

E. Renal

1. Oliguria

2. Azotaemia

3. Renal artery/vein thrombosis

F. Metabolic

1. Hyperglycaemia

2. Hypocalcaemia

3. Hypertriglyceridemia

4. Encephalopathy

5. Sudden blindness (Purtscher's retinopathy)

G. Central nervous system

1. Psychosis

2. Fat emboli

3. Alcohol withdrawal syndrome

H. Fat necrosis

1. Intra-abdominal saponification

2. Subcutaneous tissue necrosis

3.12. URINARY AMYLASE

Amylase from → pancreatic acini goes through pancreatic duct → into the duodenum.(Fig 19)

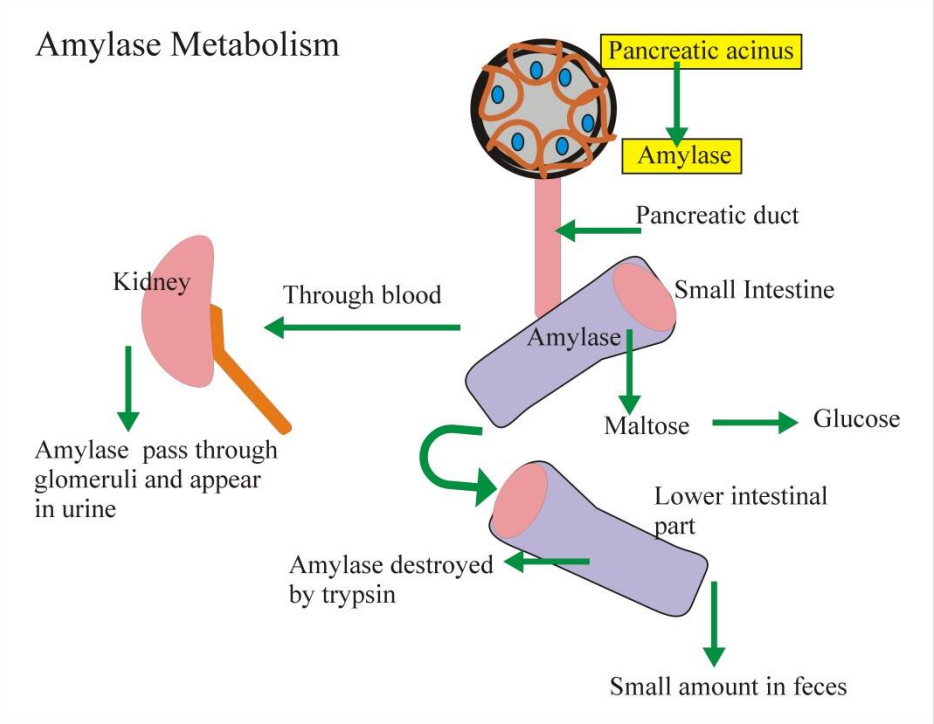

Fig 19.Amylase metabolism.

An amylase is a small unit and it can pass through the glomeruli and found in the urine.Urinary amylase clearance is increased in acute pancreatitis from normal to 3 folds. A value of > 550 U/L has a sensitivity of 62 % and 97% specific for acute pancreatitis.In damage to pancreas or salivary glands more enzyme in blood and this is excreted in the urine. In pancreatitis there is prolonged raised level of amylase in urine may be raised till 5 to 7 days.Short lived peak in blood, may be 1 to 2 days and return to normal [45].

In acute pancreatitis Amylase picture is:

1. Initial rise 2 to 12 hours.
2. Peak level is 12 to 72 hours.
3. Normal level reaches in three to four days.
4. Urine amylase may remain elevated up to 2 weeks after the acute episode of acute pancreatitis.(Fig 20)

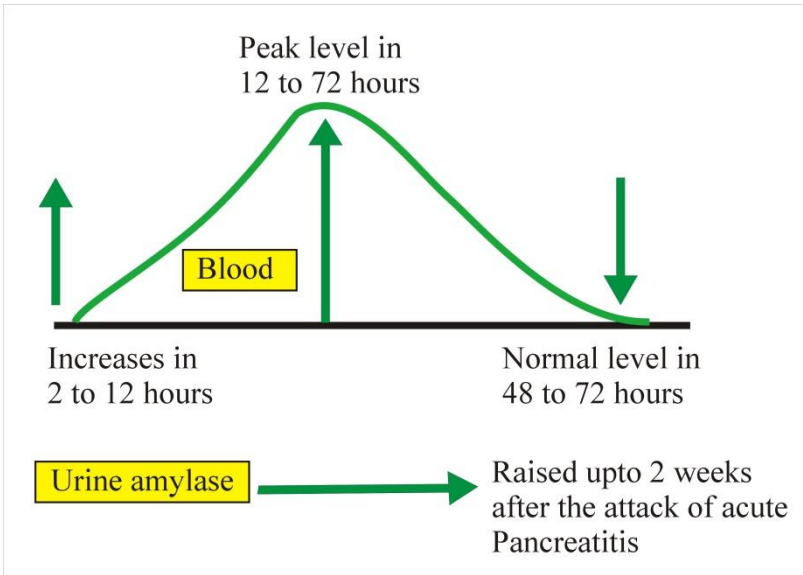

Fig 20.

The urinary amylase is a highly sensitive indicator of the presence of acute pancreatitis. The urinary excretion always remained abnormal when the serum concentration was abnormal, and the excretion remained abnormal for two to fifty days even after the serum concentration had returned to normal in the absence of renal insufficiency [7]. Thus the urinary amylase excretion can be used for the diagnosis of

subsiding pancreatitis and for convalescent care of acute pancreatitis, such as the discontinuation of bed rest, initiation of oral feeding and the start of exercise.

Urinary clearance of pancreatic enzymes from the circulation increases during pancreatitisin many cases; henceforth, urinary levels may be more sensitive than serum levels. Hence, it is recommended that amylase concentrations also be measured in the urine. Urinary amylase levels remainselevated for severaldays after serum levels have returned to normal. In patients with severe pancreatitis associated with significant necrotic damage, the pancreas may not release large amounts of enzymes into the circulation[38].

MATERIALS AND METHODS

CHAPTER 4 : MATERIALS AND METHODS

4.1. SOURCE OF DATA

4.2. TYPE OF STUDY

4.3. NUMBER OF GROUPS STUDIED

4.4. SAMPLE SIZE

4.5. INCLUSION CRITERIA

4.6. EXCLUSION CRITERIA

4.7. PARAMETERS STUDIED

4.8. PROCEDURE

4.9. METHOD OF STATISTICAL ANALYSIS

4.10. ETHICAL CONSIDERATIONS

4.1. SOURCE OF DATA

All patients admitted in Thanjavur medical college Hospital, during 2016 December to 2017September with clinically suspected acute pancreatitis in the age group 25-45 and with CT findings suggestive of acute pancreatitis will be analysed prospectively. Data on duration of symptoms, clinical findings, serum amylase, serum lipase, urinary amylase,complete hemogram, renal function test, presence of SIRS, BISAP Score and CTSI will be recorded within 24 hours of admission. Their clinical significance, correlation with severity and sensitivity of urinary amylase for the diagnosis of acute pancreatitis will be statistically analysed.

4.2. TYPE OF STUDY

One year Prospective study

4.3. NUMBER OF GROUPS STUDIED

Patients admitted with clinically suspected acute pancreatitis in the age group 25-45, with CT findings suggestive of acute pancreatitis in the department of general surgery**.**

4.4. SAMPLE SIZE

This study will be carried out on 50 patients admitted with a diagnosis of acute Pancreatitis. This study will be carried out from 2016 December to 2017September.

4.5. INCLUSION CRITERIA

1.All patients admitted with clinically suspected acute pancreatitis in the age group (25-45) both male and female.

2.CT findings suggesting acute pancreatitis.

4.6. EXCLUSION CRITERIA

- Known diabetic, hypertensive and patients with chronic kidney disease.
- Drop outs and patients not willing for study.

4.7. PARAMETERS STUDIED

Data on patient's duration of symptoms, clinical findings,serum amylase, serum lipase, urinary amylase,complete hemogram, renal function test, presence of SIRS, BISAP Score and CTSI will be recorded. Statistical analysis will be carried out.

4.8. PROCEDURE

The Questionnaire proforma is designed based on objective of the study. And it has been piloted already and suitably modified (Proforma enclosed).

It contains the following details:

- Name
- Age and sex
- Complaints
- Duration of symptoms

- Pain radiating to back
- Known alcoholic
- Last alcohol intake
- Smoker
- Previous history
- Comorbidities
- Vitals(PR,Blood pressure)
- Presence of jaundice, hydration, fever, abdominal tenderness, guarding.
- Investigations (Complete hemogram, LFT, RFT, Serum amylase, Serum lipase, Urinary amylase, USG abdomen, CECT)
- SIRS, BISAP score
- CTSI

All the above details were recorded. BISAP score and CTSI were calculated and severity of pancreatitis identified.Serum amylase and urinary amylase was done by Kit method with reagent used CNP-G3, and serum lipase by enzyme calorimetric method.The biological reference value for diagnosis of AP was taken as 28-100 U/L for serum amylase, >60 for serum lipase and >321 for urinary amylase.

4.9. METHOD OF STATISTICAL ANALYSIS

Results were expressed as mean±SE. Statistical analyses were made using Pearson Chi square test and Pearson correlation. P value < 0.05 was accepted as statistically significant. The predictive value of Urinary amylase over serum amylase was calculated by Receiver - Operating Characteristics (ROC) curve.

4.10. ETHICAL CONSIDERATIONS

This is an observational study. Informed consent will be obtained. In this study patients will be undergoing treatment and follow up on a regular basis.

OBSERVATION

CHAPTER 5: OBSERVATION

A total of fifty inpatients diagnosed with acute pancreatitis were studied. All in the age group 25-45 years. Out of the fifty cases 48 were male and 2 female. Among the 50 cases 44 (88%) was alcohol related pancreatitis and 6 was gallstone induced pancreatitis(12%)(Fig 21.). Early presentation of the cases(less than 4 days)was observedin 32 patients (64%) and late presentation (more than 4 days) was seen in 18 members(36%)(Fig 22.).

Systemic inflammatory response syndrome was evident in 38 patients (76%) and was not present in the rest 12 patients(24%)(Fig 23.). Bedside index in severity of Pancreatitis Score was 0-2 in 47 patients (94%) and 3-5 in 3 patients(6%)(Fig 24). Based on CTSeverity Index 38 cases (76%) had mild acute pancreatitis(0-3) and 12 had moderate acute pancreatitis(4-6) (24%), none had severe acute pancreatitis (7-10)(Fig 25.).

Urinary amylase was elevated in all 50 cases(Table 6,6.1).Serum amylase was elevated >100U in 38 cases,but significant (three times the upper limit >300U) in only 18 cases, and 12 cases had normal values(Fig 26,Table 4). Serum lipase was elevated (>60U) in 49 cases(98%) and normal in only 1 case(2%)(Fig 27, Table 5). Also urinary amylase was found to be grossly elevated (>1001 U) in 17(34%)patients(Fig 28,29).Among these, 7 patients had a CTSI 0-2(mild AP) and 10 patients(83.3%) had a CTSI >3(Moderate AP).But those with urinary amylase in the range 321-1000 only 2(16.7%) had CTSI>3-Moderate AP(Table 10,Fig 30). All the 18 cases with late presentation of AP had their serum amylase values either in the normal range (28-

100U) or less than three times the upper limit (<300U), but urinary amylase was consistently elevated in all these cases.

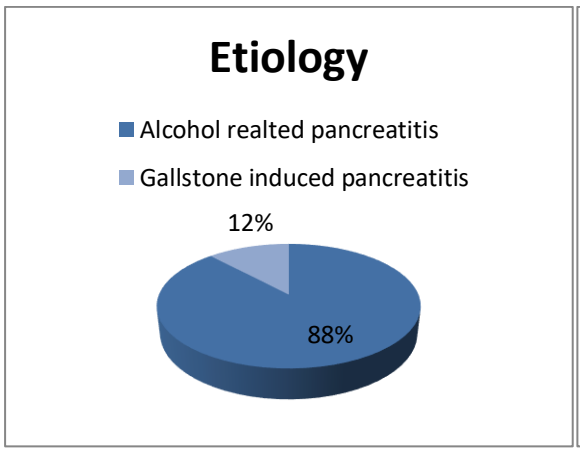

Fig 21.

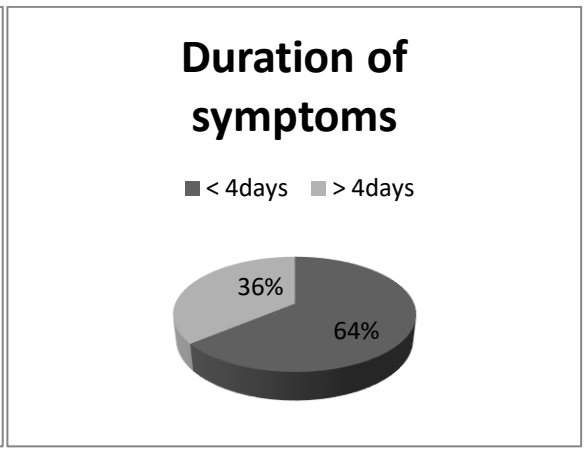

Fig 22.

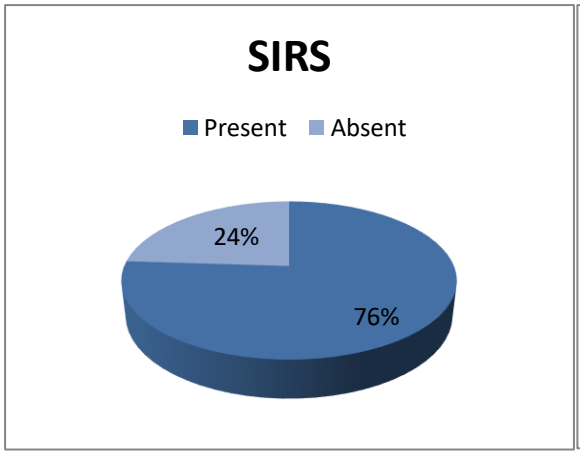

Fig 23.

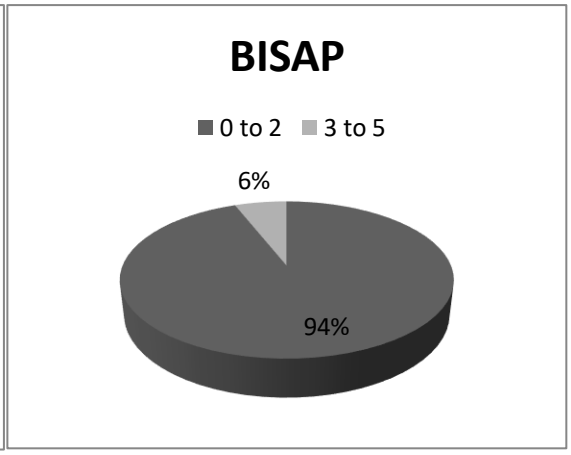

Fig 24.

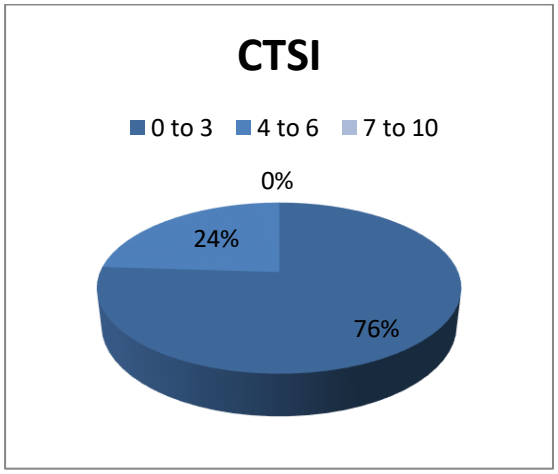

Fig 25.

1.ANALYSIS OF SERUM AMYLASE LEVEL:

Table 4.Serum amylase

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 100	12	24.0	24.0	24.0
	100 to 300	20	40.0	40.0	64.0
	300 & above	18	36.0	36.0	100.0
	Total	50	100.0	100.0	

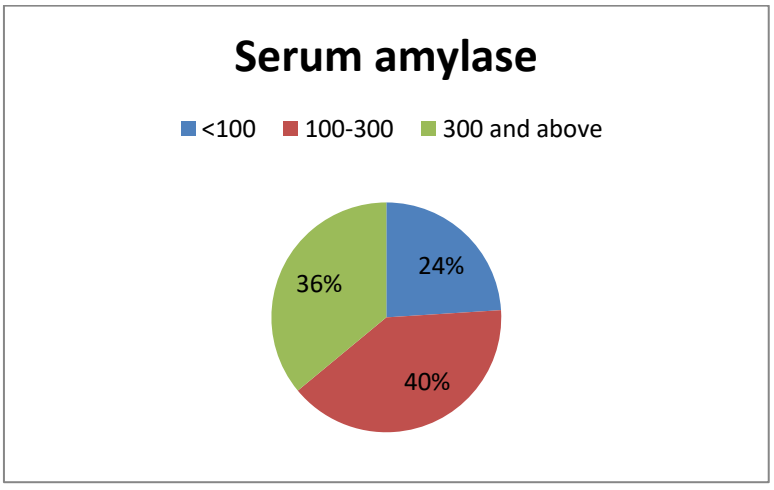

Fig.26

2. **ANALYSIS OF SERUM LIPASE LEVEL.**

Table 5.Serum lipase

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Below 60	1	2.0	2.0	2.0
	Above 61	49	98.0	98.0	100.0
	Total	50	100.0	100.0	

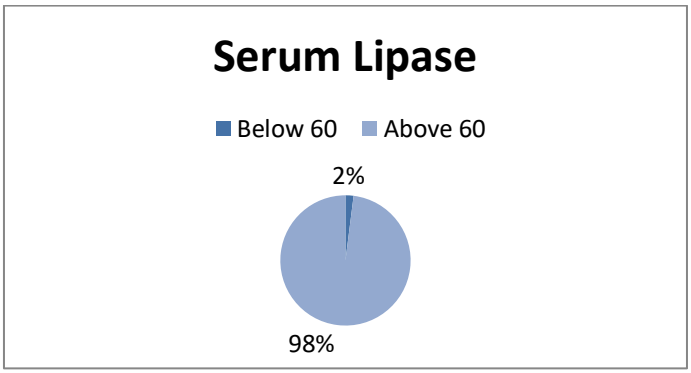

Fig 27.

3. **ANALYSIS OF URINARY AMYLASE LEVEL.**

Table 6. Urinary amylase

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	>320	50	100.0	100.0	100.0

Table 6.1 -Grossly elevated Urinary amylase levels

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	321 to 1000	33	66.0	66.0	66.0
	> 1001	17	34.0	34.0	100.0
	Total	50	100.0	100.0	

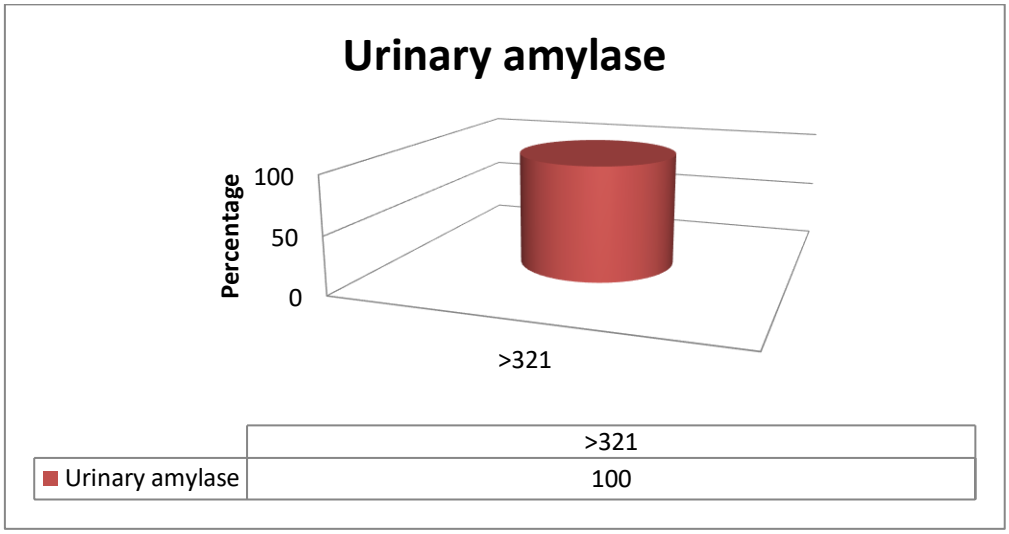

Fig 28.

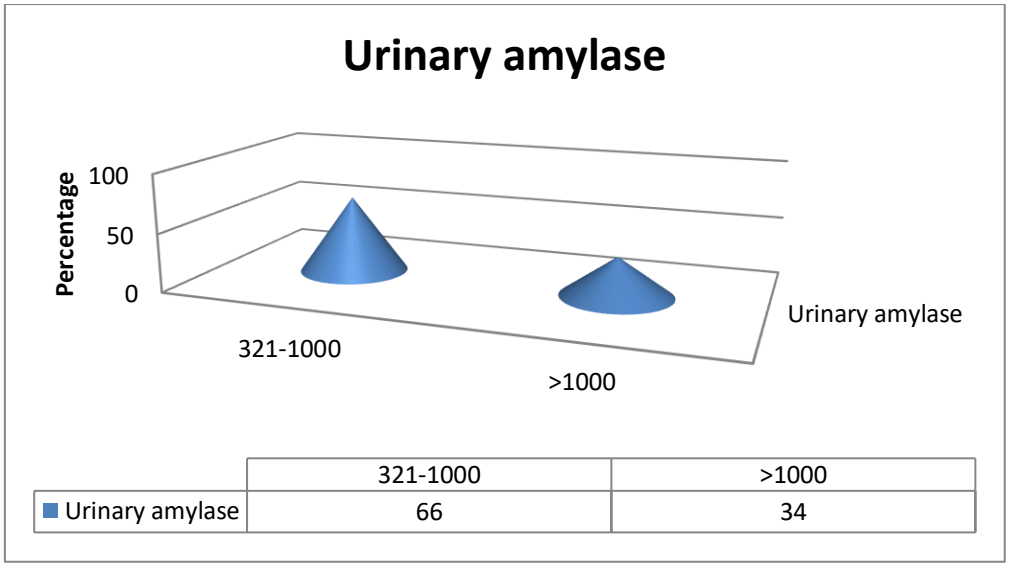

Fig 29.

4.TABLE SHOWING DESCRIPTIVE STATISTICS.

Table 7.Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Duration of symptoms	50	1	7	2.96	1.498
Serum amylase	50	70	814	286.29	204.307
Serum lipase	50	50	876	341.85	210.936
Urinary amylase	50	417	1778	927.12	372.796
BISAP score	50	0	3	1.24	.870
CTSI score	50	1	5	2.36	1.290
Valid N (list wise)	50				

5. TABLE SHOWING STATISTICAL COMPARISION OF SERUM AND URINARY AMYLASE AND ITS SIGNIFICANCE

Table 8. Crosstab Serum and urinary amylase

			Urinary amylase		Total
			321 to 1000	> 1001	
Serum amylase	Below 100	Count	10	2	12
		% within Urinary amylase	30.3%	11.8%	24.0%

	100 to 300	Count	18	2	20
		% within Urinary amylase	54.5%	11.8%	40.0%
	300 & above	Count	5	13	18
		% within Urinary amylase	15.2%	76.5%	36.0%
Total		Count	33	17	50
		% within Urinary amylase	100.0%	100.0%	100.0%

6. TABLE SHOWING T-Test OF URINARY AMYLASE AND ITS SIGNIFICANCE.

Table 9.Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided) p value
Pearson Chi-Square	18.459(a)	2	.000
Likelihood Ratio	19.016	2	.000
Linear-by-Linear Association	11.974	1	.001
N of Valid Cases	50		
P value <0.5 is significant			

7. TABLE SHOWING STATISTICAL CORRELATION OF URINARY AMYLASE WITH CTSI.

Table 10. Crosstab correlation Of CTSI and Urinary amylase

			CTSI score		Total
			1 to 3	4 & above	
Urinary amylase	321 to 1000	Count	31	2	33
		% within CTSI score	81.6%	16.7%	66.0%
	> 1001	Count	7	10	17
		% within CTSI score	18.4%	83.3%	34.0%
Total		Count	38	12	50
		% within CTSI score	100.0%	100.0%	100.0%

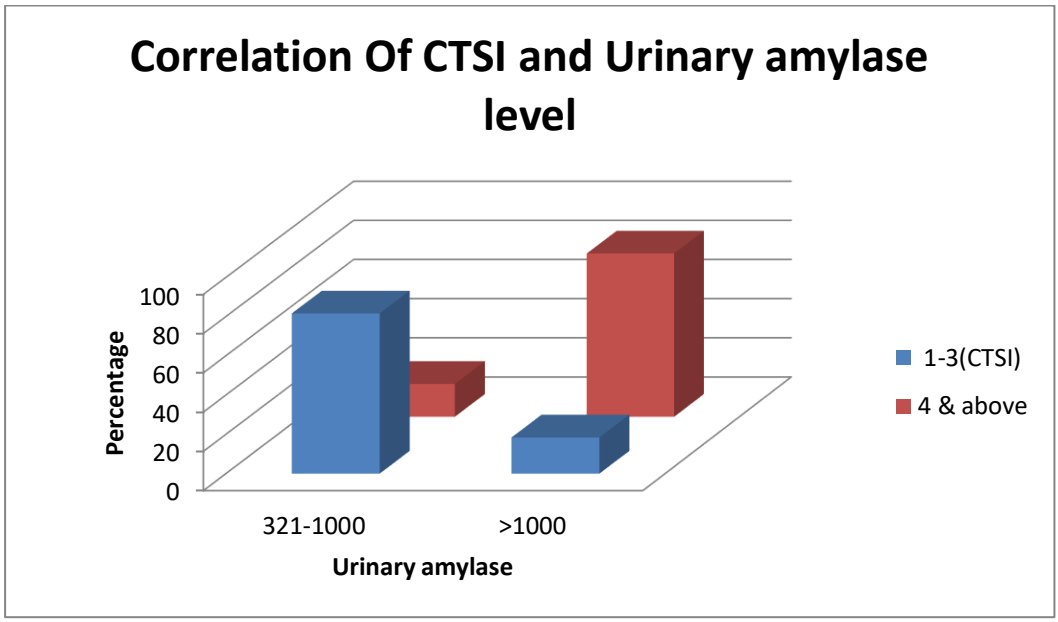

Fig 30.

8.SENSITIVITYOF SERUM AMYLASE.

ROC CURVE

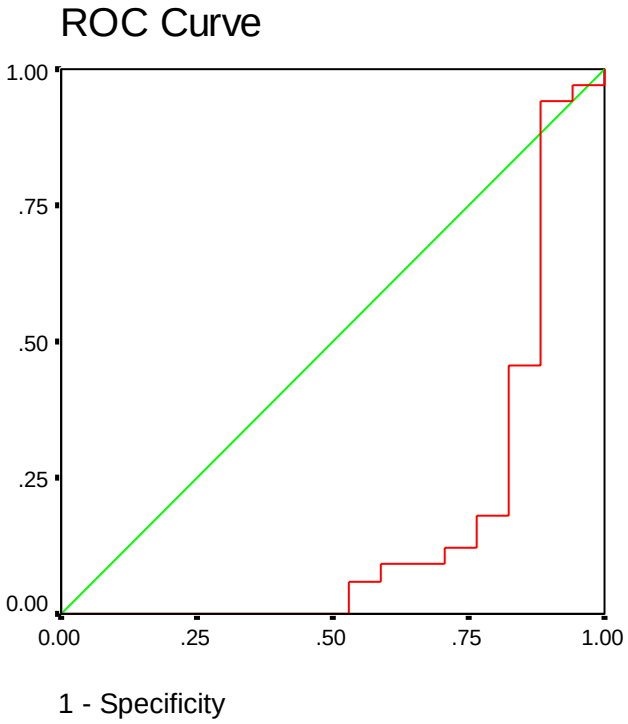

Fig 31.

Table 11. Area Under the Curve
Test Result Variable(s): Serum amylase

Area	Std. Error(a)	Asymptotic Sig.(b)	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.171	.077	.000	2.031E-02	.322

a Under the nonparametric assumption

b Null hypothesis: true area = 0.5

Coordinates of the Curve Test Result Variable(s):Serum amylase		
Positive if morethan or Equal To(a)	Sensitivity	1 - Specificity
68.90	1.000	1.000
72.65	.970	1.000
76.70	.970	.941
81.50	.939	.941
85.25	.939	.882
86.65	.909	.882
88.50	.879	.882
91.40	.848	.882
94.80	.818	.882
96.50	.788	.882
97.85	.758	.882
99.35	.727	.882
102.00	**.697**	**.882**
108.15	.667	.882
124.20	.636	.882
141.20	.606	.882
148.15	.576	.882

153.20	.545	.882
156.50	.515	.882
162.40	.485	.882
175.15	.455	.882
193.00	.455	.824
204.80	.424	.824
208.85	.394	.824
215.75	.364	.824
221.30	.333	.824
224.90	.303	.824
231.35	.273	.824
240.50	.242	.824
253.55	.212	.824
276.25	.182	.824
295.20	.182	.765
315.70	**.152**	**.765**
332.00	.121	.765
333.85	.121	.706
362.60	.091	.706
394.35	.091	.647

419.30	.091	.588
445.10	.061	.588
451.25	.061	.529
455.20	.030	.529
469.15	.000	.529
510.10	.000	.471
544.80	.000	.412
555.25	.000	.353
589.60	.000	.294
643.45	.000	.235
690.35	.000	.176
750.85	.000	.118
801.90	.000	.059
815.20	.000	.000

The smallest cutoff value is the minimum observed test value minus 1, and the largest cutoff value is the maximum observed test value plus one. All the other cutoff values are the averages of 2 consecutive ordered observed test values.

Sensitivity is around 70% if diagnostic value is taken as >100.

9. SENSITIVITY OF URINE AMYLASE.

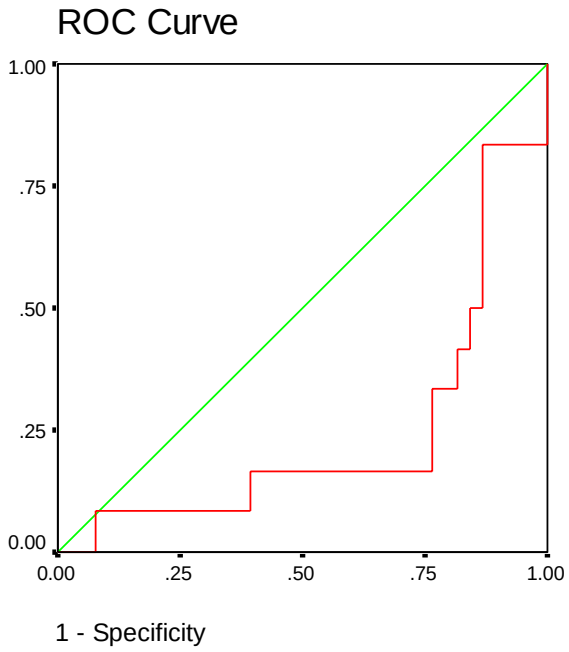

Fig 32.

Table 12. Area Under the Curve
Test Result Variable(s): Urinary amylase

Area	Std. Error(a)	Asymptotic Sig.(b)	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.239	.084	.007	7.346E-02	.405

a Under the nonparametric assumption

b Null hypothesis: true area = 0.5

Coordinates of the Curve
Test Result Variable(s): Urinary amylase

Positive if morethan or Equal To(a)	Sensitivity	1 - Specificity
415.80	1.000	1.000
423.20	.917	1.000
442.15	.833	1.000
472.00	.833	.974
494.40	.833	.947
513.15	**.833**	**.921**
527.35	.833	.895
533.95	.833	.868
547.05	.750	.868
557.10	.667	.868
562.10	.583	.868
564.45	.500	.868
566.00	.500	.842
578.60	.417	.842
601.20	.417	.816
647.90	.333	.816
683.70	.333	.789
685.55	.333	.763
698.20	.250	.763

732.85	.167	.763
761.50	.167	.737
776.10	.167	.711
785.85	.167	.684
789.35	.167	.658
844.60	.167	.632
910.10	.167	.605
942.80	.167	.579
963.50	.167	.553
973.15	.167	.526
989.90	.167	.500
998.80	.167	.474
999.45	.167	.447
1000.30	.167	.421
1001.55	.167	.395
1018.90	.083	.395
1087.20	.083	.368
1164.10	.083	.342
1195.10	.083	.316
1211.50	.083	.289

1223.05	.083	.263
1256.50	.083	.237
1307.05	.083	.211
1341.00	.083	.184
1400.95	.083	.158
1463.80	.083	.132
1512.35	.083	.105
1542.35	.083	.079
1543.25	.000	.079
1653.35	.000	.053
1770.35	.000	.026
1778.90	.000	.000
The smallest cutoff value is the minimum observed test value minus one and the largest cutoff value is the maximum observed test value plus 1. All the other cut off values are the average of 2 consecutive ordered observed test values.		

The Sensitivity for urinary amylase value >500 is around 83%.

DISCUSSION

CHAPTER 6 : DISCUSSION

Acute Pancreatitis is one of the commonest surgical emergencies. The diagnosis of acute Pancreatitis is primarily clinical. A typical patient presents with severe upper abdominal pain (epigastric) radiating to the back, nausea and vomiting and has got tenderness and sometimes guarding in the epigastric region on examination. There may be history of heavy alcohol consumption. The definite diagnosis of Pancreatitis still remains a clinical decision augmented by appropriate tests.

Serum amylase is commonly used than any other test in assisting the diagnosis of acute pancreatitis. The diagnosis of pancreatitis is not a problem in patients with typical symptoms of acute pancreatitis or elevated serum amylase values. Diagnostic problems are encountered in the acute cases with atypical presentation or that have partially subsided or in the atypical cases with normal or subclinical serum amylase value. Newer investigations like serum procalcitonin, IL -6 and urinary trypsinogen-2 are now used in the diagnosis of acute pancreatitis.But most of these investigations are expensive and require trained personnel.

Reports from Saxon et al[1], Budd et al[2] , and Gambill et al[3] has shown that the hourly excretion rate of urinary amylase could be more frequently abnormal in the presence of pancreatic diseases than the serum concentration of either amylase or lipase. In uncomplicated cases of AP Serum amylase usually remains elevated for 3–5 days.Lower activities does not rule out the diagnosis, as serum amylase activity may reduce or becomes normal within the first 24-48 hours. Measurement of urinary

amylase activity, which remains high for longer periods, may be helpful in this situation[5].

Urinary amylase is increased in acute pancreatitis and may remain elevated for 7 to 10 days after serum levels have returned to normal[6].Thus it is useful in diagnosis of atypical cases with normal serum amylase and those cases with late presentation of AP.

Urinary amylase may also be useful in cases of hypertriglyceridemia and macroamylasemia in which serum amylase values may be misguiding diagnosis of AP.There are not much studies conducted on the clinical significance of urinary amylase inAP.

Thus this study was conducted to assess theclinical significance and sensitivity of urinary amylase in the diagnosis of acute pancreatitis, and its correlation to severity was analysed.

In this Study of 50 cases of acute pancreatitis, it was found that urinary amylase was significantly elevated in all cases with Acute Pancreatitis. In cases with early presentation duration less than 4 days, both serum and urinary amylase were equally elevated. In those with late presentation, though serum amylase was not significantly elevated or normal in some atypical cases, urinary amylase was grossly elevated in those cases. In cases with moderate acute pancreatitis urinary

amylase levels were more elevated than those with mild AP, thus correlating with the severity of AP.

One study was conducted in1970 by TETSUO HAYAKAWA et al to find the clinical significance of urinary amylase in diagnosis of pancreatic diseases. This study has concluded that the urinary amylase is a highly sensitive indicator of the presence of acute pancreatitis. The urinary excretion of amylase remained always abnormal whenever the serum concentration was abnormal and the excretion remained abnormal for two to 50 days even after the serum concentration had returned to normal in the absence of renal insufficiency[7]. Thus the urinary amylase excretion can be used for the diagnosis of subsiding pancreatitis and for convalescent care of acute pancreatitis, such as the discontinuation of bed rest, initiation of oral feeding and the start of exercise.

RESULTS

CHAPTER 7 : RESULTS

Among 50 patients, 38 had mild AP and 12had moderateAP, none had SAP based on CTSI. Serum amylase, Serum lipase and Urinary amylase were analysed on the first day of admission within 24 hours.Males are more commonly affected than females. Alcohol was the leading cause of AP followed by Gall stones. In this study the biological reference value was taken as per lab, for serum amylase (28-100U/L), Serum lipase (>60 U/L) and urinary amylase (>321 U/L). The percentageof patients for mild and moderate AP for significant rise in serum amylase (3 times the upper limit), Serum lipase and urinary amylase includes 36%, 98% and 100% respectively. The standard deviation of serum amylase, serum lipase and urinary amylase includes 204.307,210.936 and 372.796 respectively.The statistical inference of all the three parameters comparing one value with other parameters shows serum andurinary amylase has significant value of $P<0.05$. Urinary amylase was found to be grossly elevated (>1000 U) in 17 patients. Among these, 3 patients had a BISAP Score >2 and 10 patients had moderate acute pancreatitis, thus correlating with disease severity. All the 18 cases with late presentation of AP had their serum amylase values either in the normal range (28-100U) or less than three times the upper limit (<300U), but urinary amylase was consistently elevated in all these cases.The values of urinary amylase was found to be more sensitive than serum amylase in diagnosis acute pancreatitis.

CONCLUSION

CHAPTER 8 : CONCLUSION

1.Urinary amylase is more sensitive than serum amylase in diagnosis of acute pancreatitis.

2.It is especially useful in cases of acute pancreatitis with late presentation, or atypical cases with normal serum amylase values.

3.It can also be useful in cases of macroamylasemia and hypertriglyceridemia were serum amylase values are not relevant.

4. It also correlates with the severity of pancreatitis.Urinary amylase is grossly elevated in patients with Moderate acute pancreatitis than mild acute pancreatitis in this study.

5.Thus Urinary amylase estimation can be a very useful non-invasive diagnostic tool for diagnosing atypical cases of AP thus reducing the morbidity in cases of AP which are missed are misdiagnosed with normal or insignificant rise in serum amylase value.

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CHAPTER 10 : ANNEXURES

10.1. CONSENT FORM

10.2. PROFORMA

10.3. DATA SHEET

10.1. CONSENT FORM

I _____ hereby give consent to participate in the study conducted by **DR.SUGUMARAN.K,** post graduate in department of GENERAL SURGERY ,Thanjavur medical college & hospital,Thanjavur – 613004 and to use my personal clinical data and result of investigation for the purpose of analysis and to study the nature of disease. I also give consent for further investigations.

Place :

Date : Signature of participant

10.2. PROFORMA

DISSERTATION ON CLINICAL SIGNIFICANCE OF SERUM AND URINARY AMYLASE IN ACUTE PANCREATITIS

DEPARTMENT OF GENERAL SURGERY

THANJAVUR MEDICAL COLLEGE

Name: Age/sex: IP NO:
DOA:

Complaints:

Duration of symptoms:

Pain radiating to back:

Known alcholic : Last alcohol intake:

Smoker:

Previous history:

Comorbidities:

Clinical examination:

General condition: Vitals: PR: BP:

Jaundice: Hydration: Fever:

Abdomen: Distension:

Epigastric tenderness: Guarding/rigidity:

Others:

Investigations:

Hb: TC: DC: Platelet:

LFT:

RFT: SIRS: BISAP SCORE:

Serum amylase: Urinary amylase: (clean catch/catheter sample)

Serum lipase: Serum calcium:

USG ABDOMEN:

CT ABDOMEN:

CT SEVERITY INDEX:

10.3. DATA SHEET

S.NO	Name	Duration of symptoms	Serum amylase	Serum lipase	Urinary amylase	SIRS	BISAP	CTSI
1	Durai manikam	1 day	618.3	445.6	1777.9	+	3	5
2	Jayabal	2 days	245	330	564.8	+	2	2
3	Kanan	3 days	549.6	545.3	1200.9	+	2	4
4	Karrupayi	4 days	236.0	109.7	999.8	+	1	2
5	Mahalingam	2 day	814.2	376.6	1762.8	+	3	5
6	Manikam	4 days	96	120	554.1	+	1	2
7	Pichairaj	3 days	290.4	142.3	1035.5	+	2	4
8	Raju	5 days	93.6	49.9	416.8	+	1	2
9	Rajendiran	3 days	85.5	67.4	429.6	+	1	1
10	Rajkumar	4 days	262.1	835.0	923.6	+	1	2
11	Sambath	3 days	156.6	242.6	526.8	+	1	1
12	Shankar	1 day	390.1	702.1	1289	+	2	2
13	Sivanantham	4 days	98.7	218.0	612.4	-	0	1
14	Suresh	2 days	203.9	325.7	527.9	-	0	1
15	Thangavel	5 days	219.5	162.9	766.6	-	0	1
16	Thirunavukarasu	5 days	75.4	76.2	1542.6	+	2	2
17	Tilak	1 day	450.2	611	1542.1	+	3	5
18	Arun	2 days	398.6	540	1325.1	+	2	4
19	Kabilan	1 day	540	446.2	1482.6	+	2	5
20	Duraisamy	5 days	89.2	220	560.1	-	0	2
21	Dhanabal	3 days	104	352	683.4	+	1	1
22	Chandrasekar	1 day	331.4	254	792.6	+	2	2
23	Patamal	3 day	223.1	356.6	999.1	+	1	2
24	Charu	2 days	440	650.1	1000.8	+	2	5
25	Murugesh	4 days	112.3	332.8	785.6	+	1	2
26	Mani	1 day	335.1	452.8	998.5	+	2	4
27	Dhayalan	5 days	87.8	204.1	709.3	-	0	2
28	Vigneshwaran	1 day	712.1	560.3	1189.3	+	2	2
29	Kumerasan	2 days	452.3	515	896.6	+	1	2
30	Sivakumar	4 days	78	66.4	687.1	-	0	2
31	Arul	3 days	226.7	365.2	981.3	+	1	2
32	Gopinath	5 days	85	90.6	1002.3	+	1	2
33	Vivek	1 day	560.9	486.1	1543.9	+	2	5
34	Anand	1 day	332.6	432	1222.1	+	1	2
35	Balaguru	3 days	69.9	87	564.1	-	0	1
36	Ramki	4 days	168.2	156.8	499.5	-	0	2
37	Palanivel	2 days	458.1	501.2	786.1	+	1	2
38	Guna	5 days	97	60.2	567.2	-	0	2
39	Anbumani	1 day	668.6	450.9	1138.9	+	2	5

40	Ashok	3 days	156.4	100.6	489.3	-	0	1
41	Senthil	2 days	300	258.4	756.4	+	1	2
42	Kaushik	1 day	789.6	300.4	1356.9	+	2	4
43	Santhosh	3 days	146.3	366	962	-	1	2
44	Kameraselvam	4days	182.1	751.9	1445.0	+	2	3
45	Prabakaran	7 days	205.7	127.4	965	+	2	2
46	Chinnathambi	2days	480.2	876.4	1224	+	2	3
47	Boominathan	4days	150	418	590	+	1	1
48	Anbu	3 days	100	412	540	+	1	1
49	Ashok	5days	212	264	684	+	1	2
50	Balasubramani	3days	136.1	276.9	454.7	-	0	1